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FIRST SPECTROSCOPY OF THE DWARF NOVA KX Aql: A POSSIBLE NEW SU UMa SYSTEM

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KX Aql (HV 5428) is a poorly studied cataclysmic variable star. The Downes et al. (2001) catalogue reports a dwarf nova nature with a rather long cycle length (300 days) and a photographic magnitude range 12.5–17.5, although the VSNET[1] and VSOLJ[2] light curves occasionally show the star fainter than 18 mag. To our knowledge, the system has not been examined spectroscopically yet. In this note we confirm the dwarf nova classification, and provide for the first time a detailed description of the optical spectrum.

We obtained a 900-s integration time spectrum of KX Aql on May 30, 2000 (JD 2451694) at the La Silla Observatory using DFOSC at the Danish 1.54-m telescope. Grism #15 combined with a slit width of $2''$ yielded a wavelength range of $\sim$ 3800–9100 Å and a spectral resolution of 15 Å. The spectrum was corrected for bias and flat fields, as well as calibrated in wavelength and flux using standard IRAF[3] routines.

The spectrum of KX Aql is presented in Fig. 1. It shows typical dwarf nova features, with strong emission lines of the Balmer and HeI series. Additionally, CaII H (hidden in Hε) and K emission is present at the blue, and the CaII triplet (blended with the Paschen series) at the red end of the spectrum. Table 1 contains all identified emission lines and their basic quantities. Note especially the extraordinary strength of the Hα line ($W_{\mathrm{H}\alpha} > 300$ Å), and the absence of highly ionized lines like HeII. The spectrum furthermore shows no absorption features which could be assigned to the secondary star. A few emission lines remained unidentified due to the low resolution of our data, two other were tentatively assigned to FeII, but a final conclusion has to await high-resolution spectroscopy.

The normalized spectrum in the lower part of Fig. 1 was computed by dividing the calibrated spectrum through a spline fit to the continuum. It emphasizes the strong Balmer decrement, suggesting an origin in an optically thin accretion disc. This, and the strong emission lines in general, indicate that the system was in quiescence during our observations. We folded the calibrated spectrum with Bessell (1990) filtercurves in order to extract spectrophotometric magnitudes, obtaining

$$V = 18.4, \quad B - V = -0.5, \quad V - R = 0.2.$$

[1] http://www.kusastro.kyoto-u.ac.jp/vsnet/gcvs/AQLKX.html
[2] http://www.kusastro.kyoto-u.ac.jp/vsnet/etc/drawvsolj.cgi?text=AQLKX
[3] IRAF is distributed by the National Optical Astronomy Observatories.

Table 1: Properties of the emission lines. Column 1 gives the wavelength determined by a Gaussian fit, column 2 the equivalent width, column 3 the Gaussian FWHM, column 4 the integrated line flux, column 5 and 6 the line identification and the corresponding rest wavelength, respectively. The flux is in units of 10^{-16} erg cm^{-2} s^{-1}. All other values are in Å. Colons mark uncertain values

(1) λ	(2) W_λ	(3) FWHM	(4) F_λ	(5) identification	(6) λ_0	(7) remarks
3898	−47:	20	271:	Hζ	3889	[1]
3943	−45:	11	246:	CaII K	3934	[1]
3979	−54:	21	289:	Hε + CaII H	3970	[1]
4109	−62	24	293	Hδ	4102	
4191	−9	35	31	FeII	4179	uncertain
4244	−7	20	21	FeII	4233	uncertain
4293	−12	13	16			ID?
4347	−111	25	264	Hγ	4341	
4424	−4	20	10			ID?
4479	−15	23	33	HeI	4472	
4867	−159	26	265	Hβ	4861	
4928	−13	23	19	HeI	4922	
4971	−4	30	5			ID?
5028	−13	39	24	HeI	5016	
5176	−13	30	22	FeII	5169	
5882	−60	33	61	HeI	5876	
6566	−320	30	282	Hα	6563	
6681	−32	41	25	HeI	6678	
7068	−25	42	24	HeI	7065	
8515	−76	91	57	CaII/Pa blend		
8665	−41	62	25	Pa13/CaII	8665/8662	
8757	−37	87	17	Pa12	8751	
8881:	−23:	40:	10:	Pa11	8863	[2]

[1] lines are strongly blended

[2] line distorted due to absorption feature (CCD error)

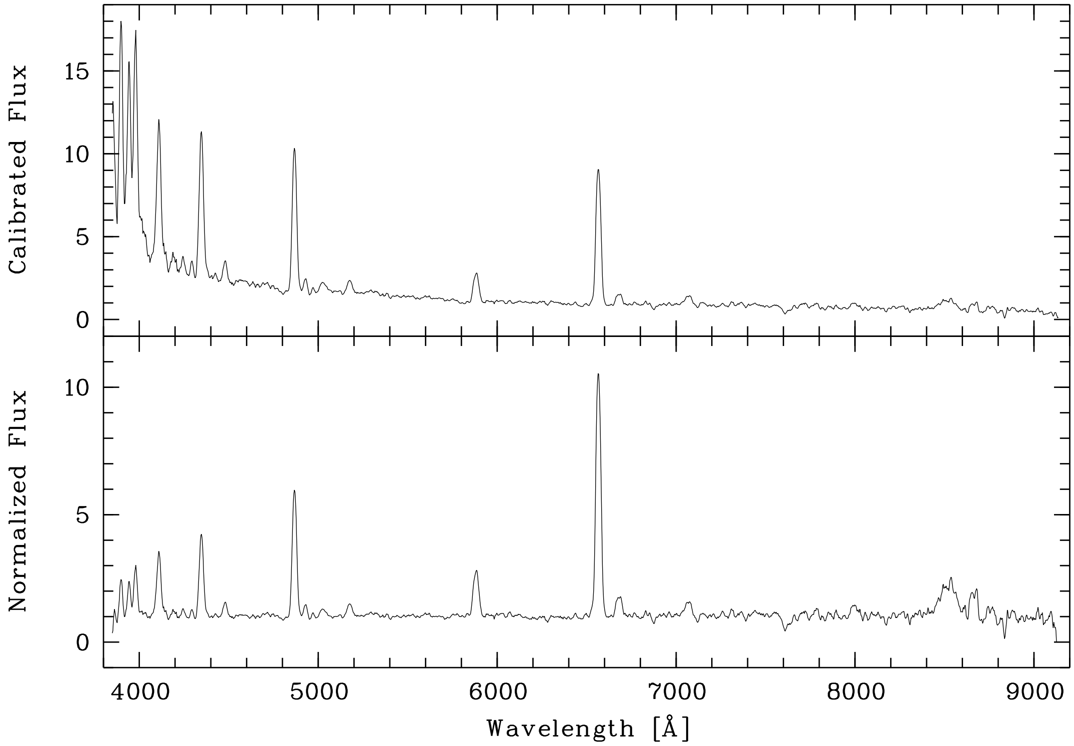

Figure 1. Flux calibrated (in 10^{-16} erg cm^{-2}s^{-1}Å^{-1}, top) and continuum normalized (bottom) spectra of KX Aql

The recorded seeing during the observations was of the order $1''.5$. On the basis of previous experiences with the instrumental setup at the 1.54 Danish, we thus expect the calibration to be better than $\sim 0^{\mathrm{m}}.15$ in V considering the slit width of $2''$. This confirms the quiescent state of KX Aql during the observation. It furthermore means that, if the maximum V magnitude is not too far from the listed photographic value of 12.5 (Downes et al., 2001), the system shows long-term variations with $\Delta V \geq 6$ mag.

The optically thin disc, suggested by the properties of the emission lines, points to a state of low accretion rate, and the disc luminosity, i.e. its continuum emission, can be expected to be rather low. The absence of late-type absorption features (e.g., NaI or TiO) therefore indicates a faint secondary star. This, together with the probable large outburst amplitude and the long recurrence time, suggests that KX Aql is a member of the SU UMa star subclass of cataclysmic variables, i.e. a dwarf nova below the period gap with a secondary star less massive than $\sim 0.3\ M_{\odot}$. The observation of a superoutburst, or the determination of the orbital period, should be the definitive probe of this prediction.

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OUTBURST PHOTOMETRY OF IZ And

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IZ And (= S 10794) is a dwarf nova discovered by Meinunger (1975), who recorded two outbursts. The object was later rediscovered by Stepanian (1982), who spectroscopically observed one of its outburst, and gave a classification as an O-B star. This classification is consistent with a low-resolution spectrum of dwarf nova at maximum. Meinunger and Andronov (1987) reported another outburst detection, and gave a discussion on its outburst cycle length. The star, however, has been largely neglected.

In the course of CCD survey of dwarf novae, the author detected another outburst at $V = 15.6$ on 1996 September 15.678 (Kato 1996). We performed time-resolved CCD photometry during this outburst.

The observations were done on three nights between 1996 September 15 and 17, using a CCD camera (Thomson TH 7882, 576×384 pixels, on-chip 2×2 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (focal length = 4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 60 s. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based PSF photometry package developed by the author. The magnitudes were determined relative to GSC 2807.1784 ($V = 12.03$), whose constancy during the run was confirmed using the check stars GSC 2807.1974 ($V = 12.86$). The magnitudes of comparison stars were determined using the RX And sequence (Misselt 1996). Barycentric corrections to observed times were applied before the following analysis. Table 1 lists the log of observations, together with nightly averaged magnitudes.

Figure 1 shows the overall light curve of the 1996 September outburst. The object gradually faded, at a maximum rate of 0.48 ± 0.11 mag d^{-1}. This rate of decline is a typical value for an SS Cyg-type dwarf nova. Using Bailey's relation (e.g. Warner 1995), this rate of decline correspond to an orbital period of 5 h. Figure 2 shows the result of time-series photometry on September 15. Although there seem to exist low-amplitude irregular variations (flickering), no evidence of superhumps was detected. Power spectrum of the data did not reveal any significant periodicity between $0^{\mathrm{d}}.002$ and $0^{\mathrm{d}}.1$. The overall behavior is consistent with the suggested orbital period from the decline rate, and supports the classification as an SS Cyg-type (UGSS in GCVS) star.

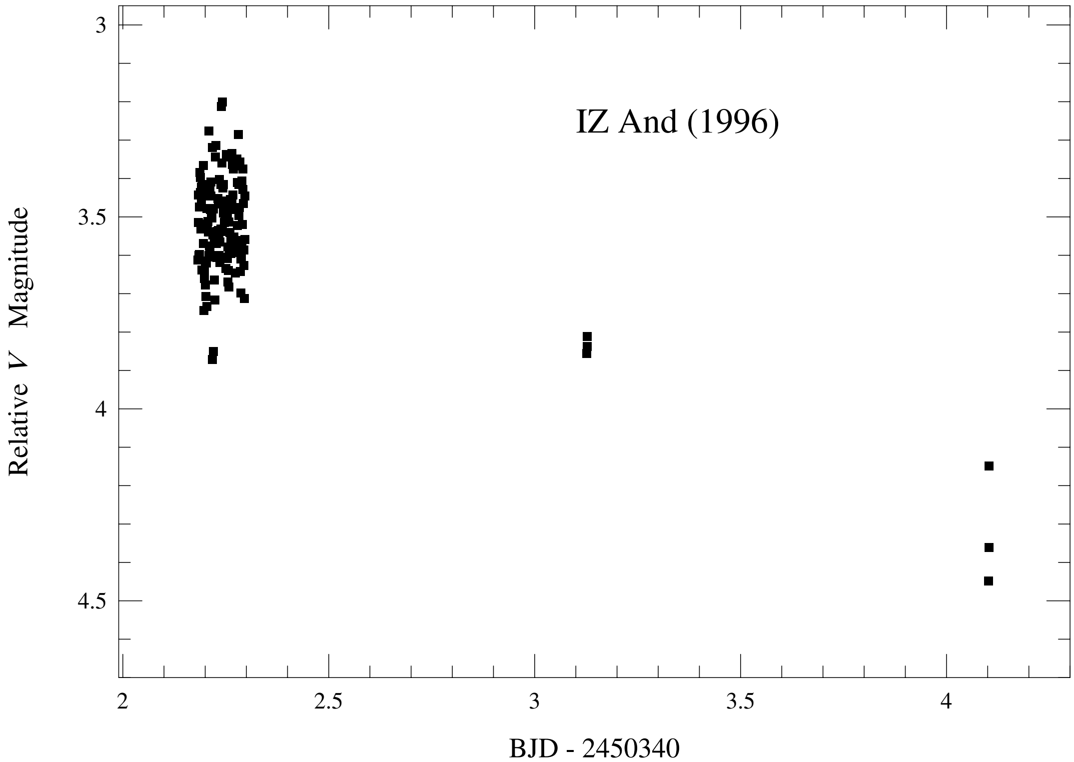

Figure 1. Light curve of the 1996 September outburst of IZ And

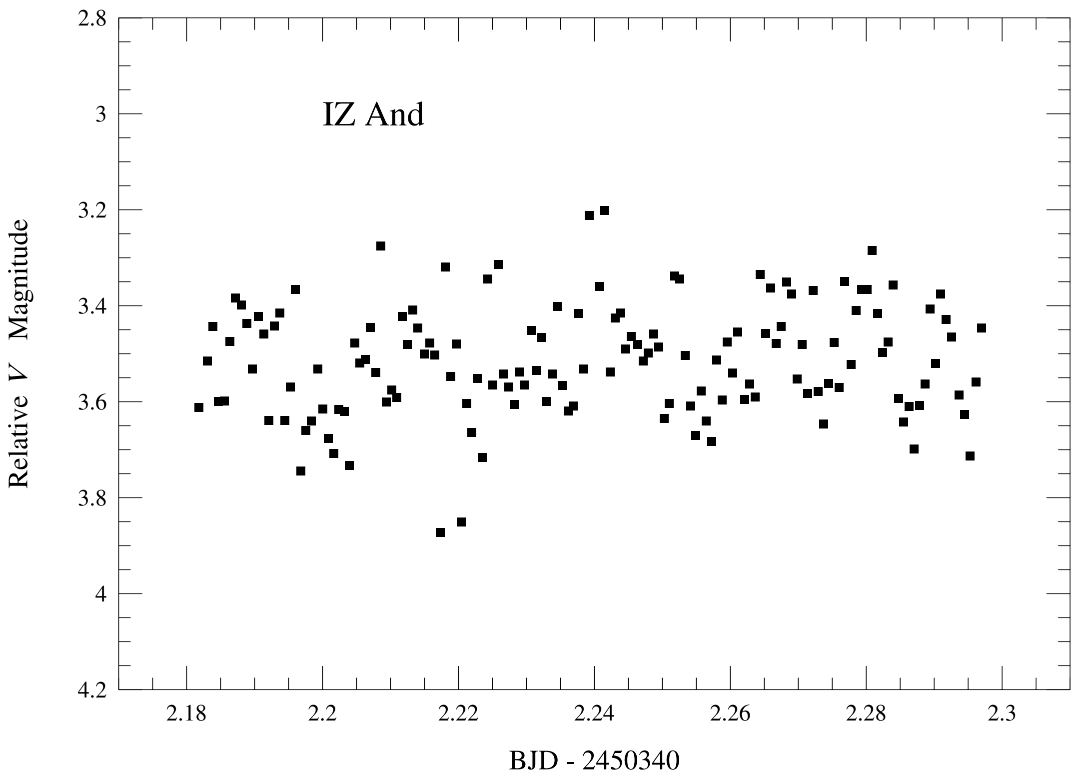

Figure 2. Light curve of IZ And on 1996 September 15. Only low-amplitude irregular variations were present

Table 1: Nightly averaged magnitudes of IZ And

start[a]	end[a]	mean mag[b]	error[c]	N^d
50342.182	50342.297	3.509	0.010	145
50343.127	50343.128	3.835	0.016	3
50344.102	50344.104	4.312	0.112	3

[a] BJD − 2400000
[b] Magnitude relative to GSC 2807.1784
[c] Standard error of nightly average
[d] Number of frames

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OUTBURST PHOTOMETRY OF FX Cep

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FX Cep (= GR 95) was discovered by Rosino (1962) as a dwarf nova. Rosino (1962) reported frequent outburst, with the shortest interval between them being 11 d, and the presence of a long outburst. The pattern of outbursts is thus somewhat reminiscent of an active SU UMa-type dwarf nova. The detection of an outburst was announced by Vanmunster (1995). We started time-resolved CCD photometry in order to search for possible superhumps.

The outburst observations were done between 1995 July 31 and August 5, using a CCD camera (Thomson TH 7882, 576 × 384 pixels, on-chip 2 × 2 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (focal length = 4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 60–90 s, depending on the transparency. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based aperture photometry package developed by one of the authors (TK). A total of 134 useful frames were obtained during this outburst. In addition to this, we observed this star in quiescence in two occasions on 1990 August 10 and 1995 February 27. The magnitudes were determined relative to GSC 4259.2106 (GSC magnitude 12.00), whose constancy during the run was confirmed using GSC 4259.690 (GSC magnitude 11.64). Barycentric corrections were applied to the observed times before the following analysis. Table 1 lists the log of observations, together with nightly averaged magnitudes.

The 1995 July–August outburst lasted at least six days, which is comparable to the long outburst reported by Rosino (1962). The outburst rose and faded slowly, and did not resemble a superoutburst of an SU UMa-type star, which has a linear plateau portion. Figure 2 depicts the detailed light curve obtained on 1995 July 31. A 3.8 hour continuous run did not reveal any hint of superhumps. This object is thus classified as an SS Cyg-type dwarf nova (UGSS type in GCVS). The object was spectroscopically observed by Liu et al. (1999). They reported the detection of features of the secondary, which implies that FX Cep is a relatively long-period system. This finding is consistent with our classification as an SS Cyg-type star.

The average of three frames taken in quiescence has yielded an averaged magnitude (relative to GSC 4259.2106) of 6.78 ± 0.50. The total amplitude of the outburst is thus

Table 1: Nightly averaged relative magnitudes of FX Cep

start[a]	end[a]	rel. mean mag[b]	error[c]	N^d
48114.167	48114.168	6.82	0.73	2
49776.329	49776.329	6.71	-	1
49930.124	49930.243	2.790	0.003	100
49931.279	49931.284	2.571	0.111	5
49932.281	49932.292	2.745	0.046	13
49933.309	49933.312	2.779	0.114	6
49934.307	49934.312	2.749	0.070	6
49935.305	49935.309	3.148	0.092	4

[a] BJD − 2400000
[b] Magnitude relative to GSC 4259.2106
[c] Standard error of nightly average
[d] Number of frames

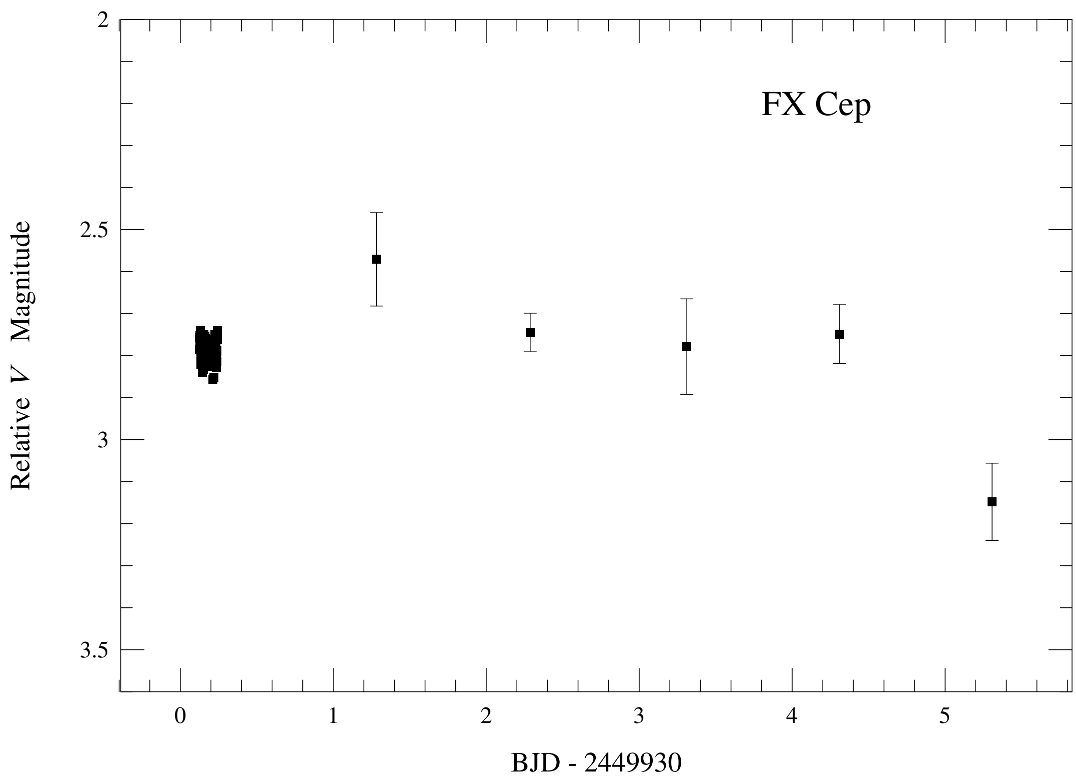

Figure 1. Light curve of the 1995 July-August outburst of FX Cep. Nightly averaged magnitudes and errors are given except for the first night

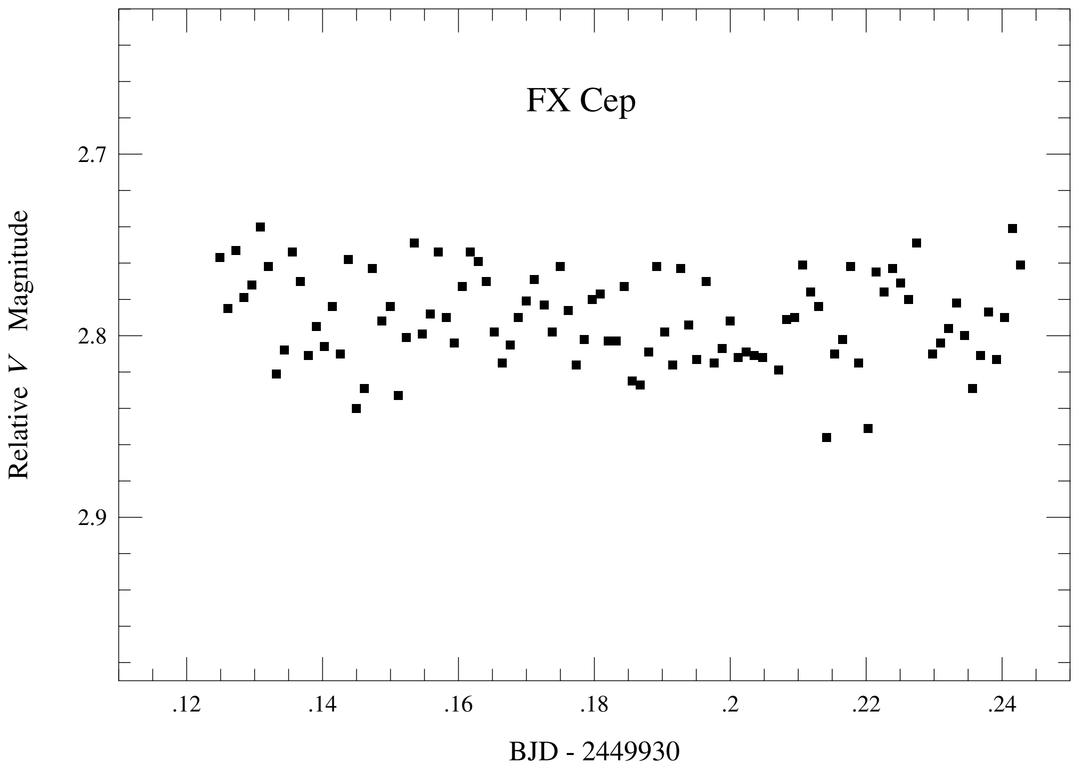

Figure 2. Light curve on 1995 July 31

4.2 ± 0.5 mag. This value is remarkably larger than was originally reported ($2^{\mathrm{m}}_{.}5$ mag), which may have been due to the confusion with the close companion by Rosino (1962). The correct identification is given in Downes et al. (1997).

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DEVELOPMENT OF LATE SUPERHUMPS IN YZ Cnc

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YZ Cnc is a well-known dwarf nova and is a prototype object representing for a population of SU UMa-type systems with short outburst recurrence times and long orbital periods. However, little photometric observation of superhumps had been done since its identification as an SU UMa-type star (Patterson 1979). We undertook time-resolved CCD photometry during its superoutburst in 1994 January.

The observations were done on three successive nights between 1994 January 1 and 3, using a CCD camera (Thomson TH 7882, 576 × 384 pixels, on-chip 2 × 2 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (focal length = 4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 60–120 s depending on the brightness of the object. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based aperture photometry package developed by the author. The magnitudes of the object were determined relative to GSC 1939.1130 (GSC magnitude 13.4), but its constancy was not confirmed because of the lack of suitable check stars in the same field. Barycentric corrections to observed times were applied before the following analysis. Table 1 lists the log of observations, together with nightly averaged magnitudes.

The light curve drawn from these data is presented in Figure 1. The light curve shows the declining portion from a superoutburst. Superhumps were evident on the first night, but became more complex on the next night, when the system entered the rapidly declining phase. The period analysis over the entire, or selected, data sets does not yield a coherent signal, because of the development of late superhumps as described below. So we used the primary superhump period of $P = 0\overset{d}{.}09204$ (Patterson 1979) for the following analysis.

Figure 2 shows the phase-averaged light curves of 1994 January 1 (upper panel) and January 2 (lower panel). The January 1 light curve clearly shows typical superhumps, with a shoulder (secondary superhumps) on its declining branch. However, the phase of the maximum dramatically changed by $\phi \sim 0.3$–0.4 on the next night (lower panel). The newly appeared humps correspond to what are called "late superhumps" (Haefner et al. 1979), which is considered to reflect the modulation of the precessing accretion disk properties at the stream impact point (Hessman et al. 1992). The clear appearance of late superhumps in YZ Cnc may be consistent with its high mass-transfer rate.

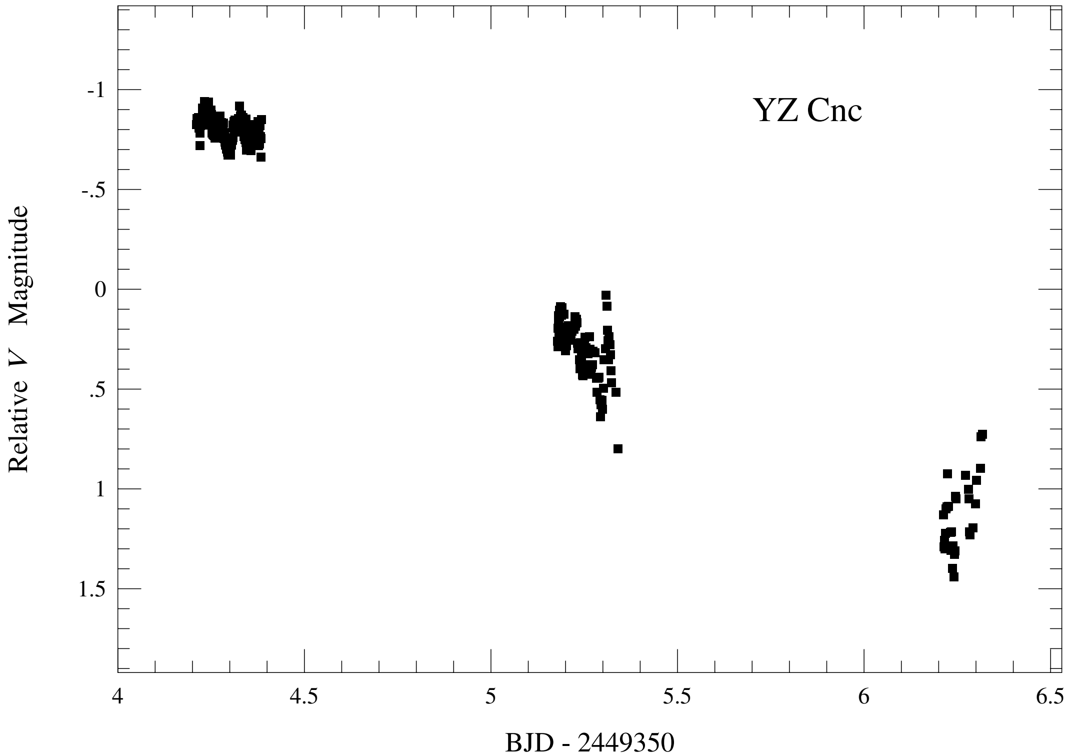

Figure 1. Light curve of the 1994 January superoutburst of YZ Cnc

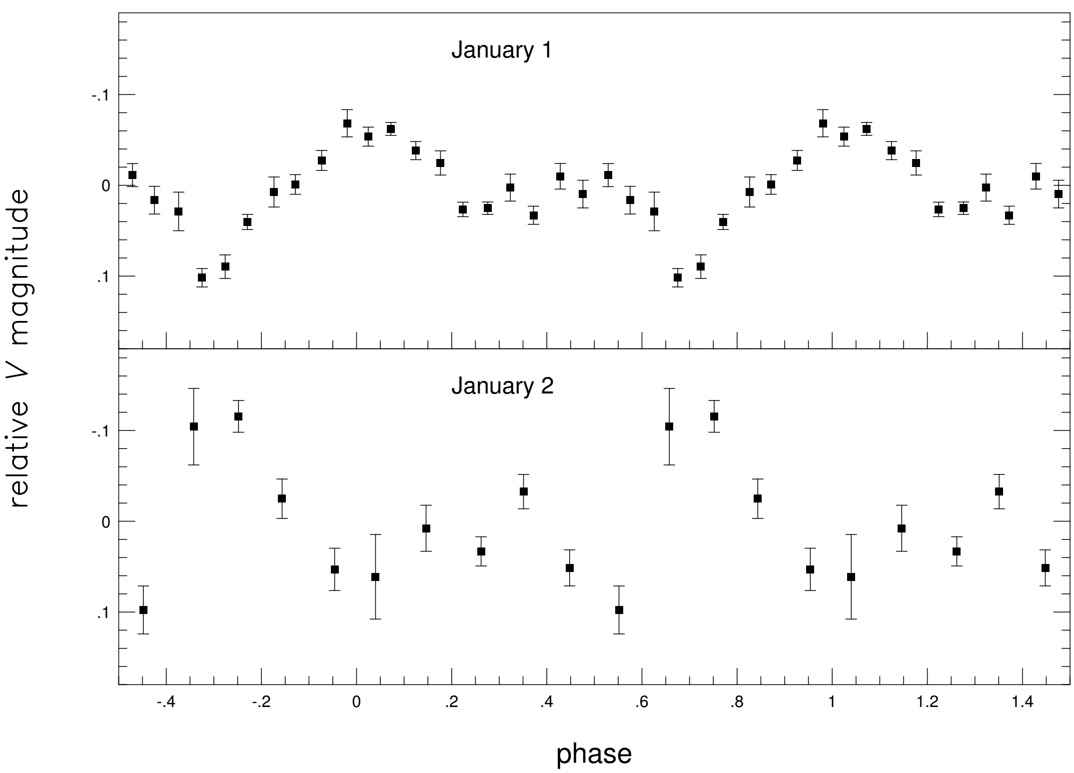

Figure 2. Phase-averaged light curve of YZ Cnc, assuming the superhump period of $0\overset{d}{.}09204$. The origin of the phase is arbitrarily taken as BJD 2449350

Table 1: Log of observations

start[a]	end[a]	mean mag[b]	error[c]	N^d
49354.211	49354.385	−0.800	0.005	162
49355.178	49355.340	0.285	0.014	94
49356.213	49356.317	1.119	0.035	30

[a] BJD − 2400000
[b] Magnitude relative to GSC 1939.1130
[c] Standard error of nightly average
[d] Number of frames

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TIME-RESOLVED PHOTOMETRY OF AH Eri IN OUTBURST

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AH Eri is a dwarf nova which had been a candidate for a system with a short orbital period (Szkody 1987). Szkody et al. (1989) performed CCD photometry in quiescence, and found 0.1–0.3 mag modulations with a period of 42 ± 2 min. Szkody et al. (1989) interpreted this period as the possible spin period of a magnetic white dwarf, as in DQ Her systems. However, since the similar period in AL Com, which Howell and Szkody (1988) originally attributed to the spin period, later turned out to be the double-wave modulations of the 81.6-min orbital period (for an extensive review of the object, see Nogami et al. 1997), a question was raised whether the reported 42-min periodicity in AH Eri actually reflects the spin period or is rather related to the orbital period.

The question remained unsettled until the discovery of the firm orbital period of 5.74 hours by Thorstensen (1997). Thorstensen (1997) also argued against the spin-period interpretation of the 42 ± 2 min by Szkody et al. (1989), based on the low strength of He II emission lines, which are usually strong in magnetic cataclysmic variables.

An outburst of AH Eri was announced on 1997 February 28 (Hers 1997). We performed time-resolved CCD photometry on 1997 March 1 in order to test the presence of the claimed 42 ± 2-min periodicity. The observations were done using a CCD camera (Thomson TH 7882, 576×384 pixels, on-chip 2×2 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (focal length = 4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 40 s. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based aperture photometry package developed by one of the authors (TK). The magnitudes were determined relative to GSC 5319.1471 ($V = 12.18$, $B - V = +0.63$), whose short-term constancy was confirmed using GSC 5319.1526 ($V = 12.56$, $B - V = +0.65$). The magnitudes are taken from Henden and Honeycutt (1997). A total of 90 useful frames were obtained. Barycentric corrections to observed times were applied before the following analysis.

The light curve drawn from these observations is presented in Figure 1. The light curve shows a slow fading, but there were no apparent periodic variations. After removing the linear fading trend, we performed a period analysis between $0\overset{d}{.}02$ and $0\overset{d}{.}04$ using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978). The analysis did not yield a significant periodicity. Figure 2 shows the phase-averaged light curve folded by the reported period of 42 min. The light curve suggests that the 42-min period may have

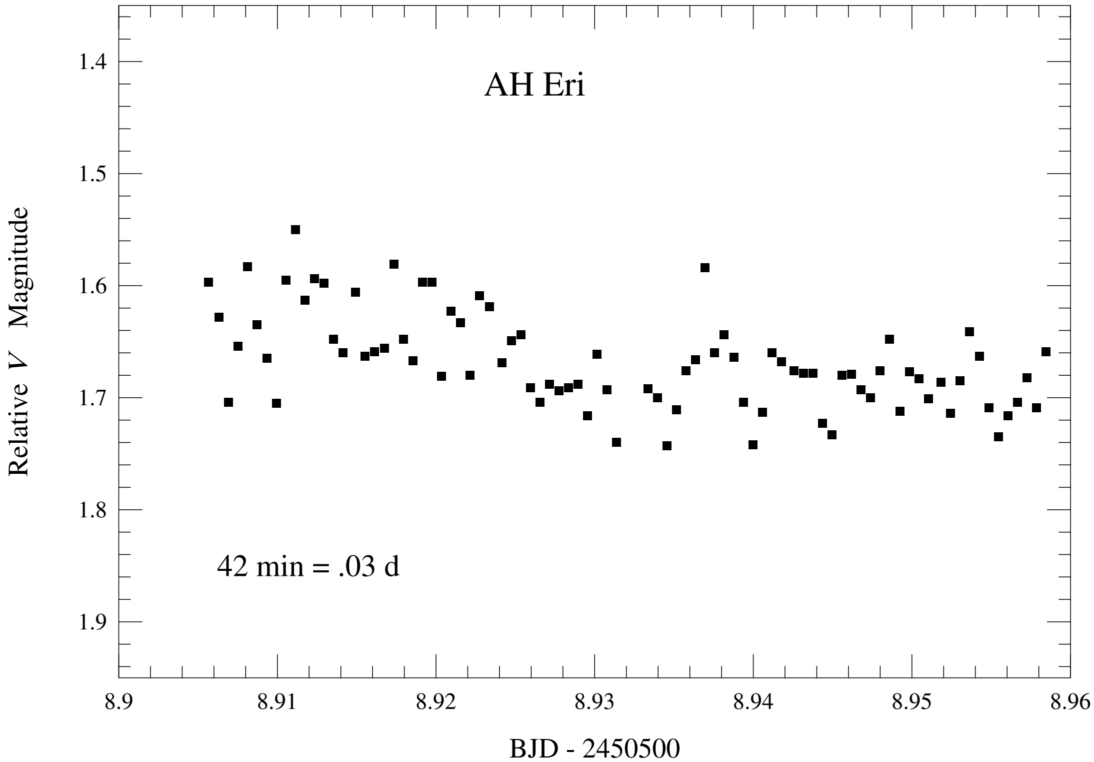

Figure 1. Light curve of AH Eri on 1997 March 1

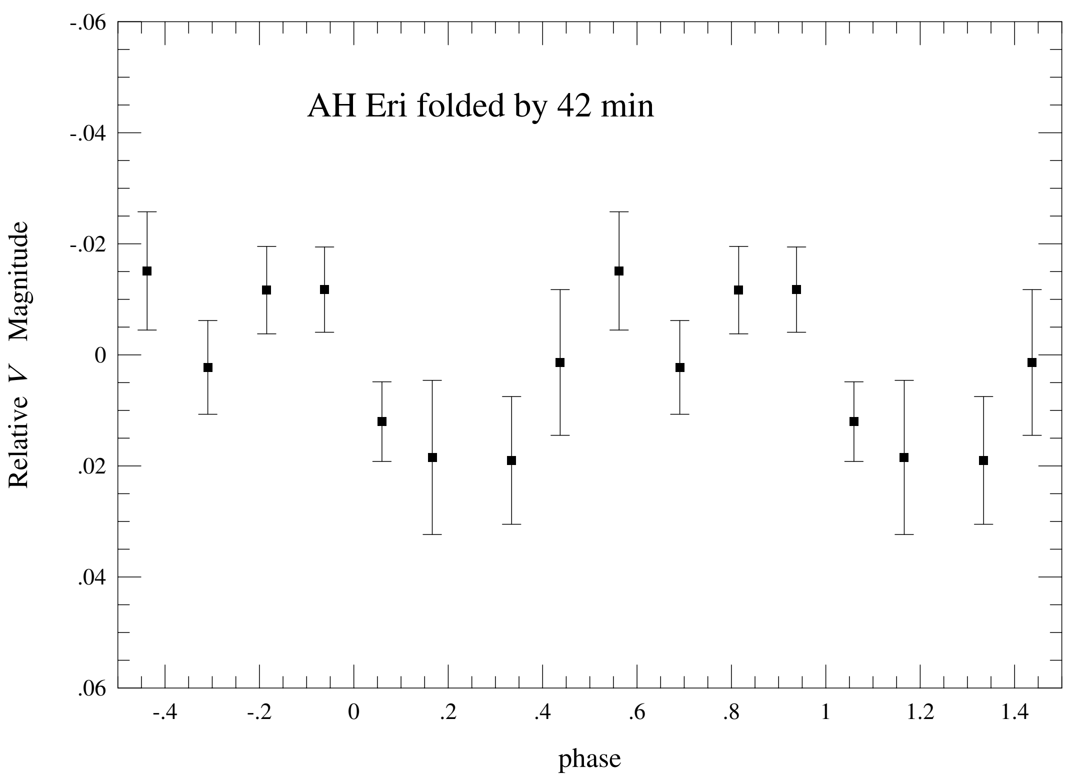

Figure 2. Light curve of AH Eri folded by a test period of 42 min

been marginally detected. But because of the lack of a firm signal in period analysis, we adopt the observed full amplitude ($0\overset{m}{.}03$) at the supposed 42-min period as the upper limit of this periodicity. The upper limit of $0\overset{m}{.}03$ is 3 to 10 times smaller than reported in Szkody et al. (1989). We conclude that the claimed 42-min periodicity of AH Eri did not appear, or was markedly reduced in amplitude, during its 1997 outburst.

The authors are grateful to VSNET members for providing observations, and to J. Hers for promptly notifying the outburst.

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DISCOVERY OF PULSATIONS IN A5(8) V COMPONENT OF THE ALGOL-TYPE SYSTEM TW Dra

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According to the strategy of Central Asian Network (CAN) collaboration (Mkrtichian et al., 1998) we are carrying out the survey for search for and study of new pulsating components in eclipsing binary stars. In the previous two publications (Mkrtichian and Gamarova, 2000; Gamarova et al., 2000) we reported about our first discoveries of new pulsating components in eclipsing binary systems R CMa and AS Eri. In this paper we present our third detection of δ Scuti-type pulsation in the primary component of the semi-detached eclipsing binary system TW Dra.

TW Dra is a semi-detached binary system with A5(8) V primary and K0 III secondary components. According to spectral class the primary component of TW Dra is situated inside the instability strip and was included to our list of target stars. Photoelectric observations of TW Dra through Johnson V filter using comparison HD 138852 ($V = 5.758$, Sp = K0III) and check HD 139549 ($V = 9.13$, Sp = F8) stars were carried out on April 26/27 and 28/29 2001 (JD 2452026, JD 2452028) with the 0.48-m telescope at Tien-Shan Astronomical Observatory (Kazakhstan). The data were reduced using standard reduction procedures for differential data. The magnitude differences between TW Dra and HD 138852 folded with the orbital period are shown on Fig. 1. The phases of orbital period were calculated according to the GCVS ephemeris HJD(Min I) $= 2444136.2956 + 2.806847 \times E$ (Kholopov et al., 1985).

Our observations covered the descending branch of the primary minima (JD 2452026) and out-of-eclipse part of the orbital light curve (JD 2452028) (see Fig. 1). For search for and analyse short-periodic pulsational variability we removed the orbital trends from the light curve. The pulsational light curves of the two nights are plotted in Fig. 2. The small-amplitude variations appear during both nights including the night which corresponds to the descending branch of primary minima.

The time series analyses were carried out with Kurtz's modification (Kurtz, 1985) of the Discrete Fourier Transform (DFT) algorithm of Deeming (1975). For determination of accuracy of the obtained values of frequency and amplitude of pulsations we used routines "Four", which realizes least-squares multi-frequency method of differential corrections fitting the multi-frequency signal simultaneously with set of given frequencies (Andronov, 1994). The amplitude spectrum of the two nights is shown in the top panel of Fig. 3. The highest peak at 17.99 ± 0.02 c/d ($P = 0\overset{d}{.}0556$) with semi-amplitude of about 2.1 ± 0.3 mmag is well visible and confirms the presence of pulsation. The amplitude spectrum of the residual is shown in the bottom panel of Fig. 3. It does not show any prominent peak above the noise level. The sine-wave fit with the period of 0ᵈ.0556 for both nights is shown in Fig. 2 by a solid line. The phase curve folded with the same period is shown in Fig. 4.

Adopting the $M = 1.7M_{\odot}$ and radius $R = 2.4_{\odot}$ for TW Dra (Svechnikov and Kuznetsova, 1990) we determined the mean density of the primary $\rho/\rho_{\odot} = 0.123$ that gives the pulsation constant $Q = 0.0190$. This value is close to the 2nd overtone of low ℓ-degree modes (Fitch, 1981).

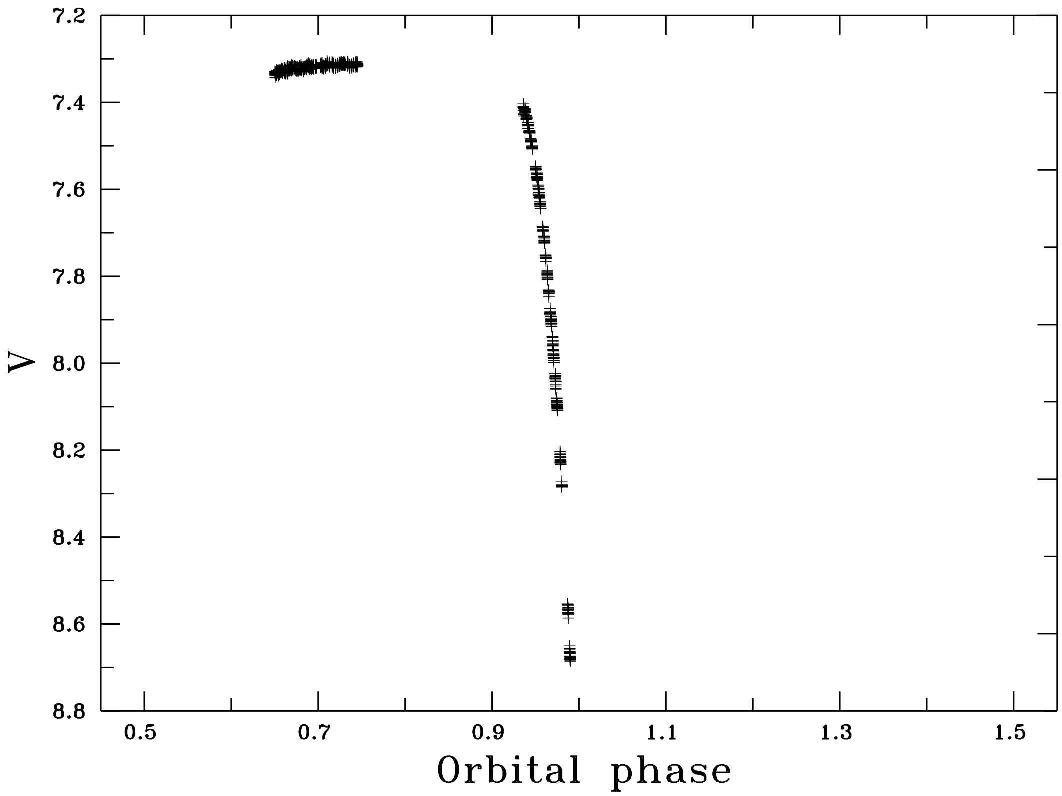

Figure 1. The orbital light curve

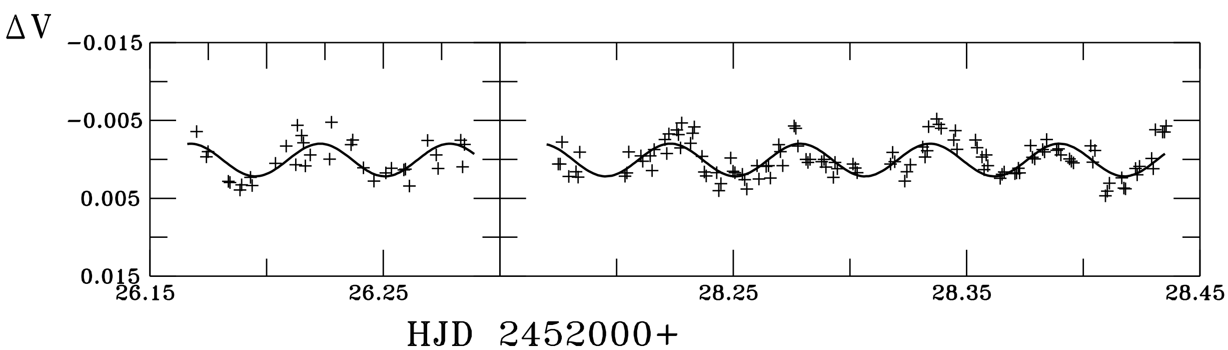

Figure 2. The pulsation light curves. Orbital trends are removed

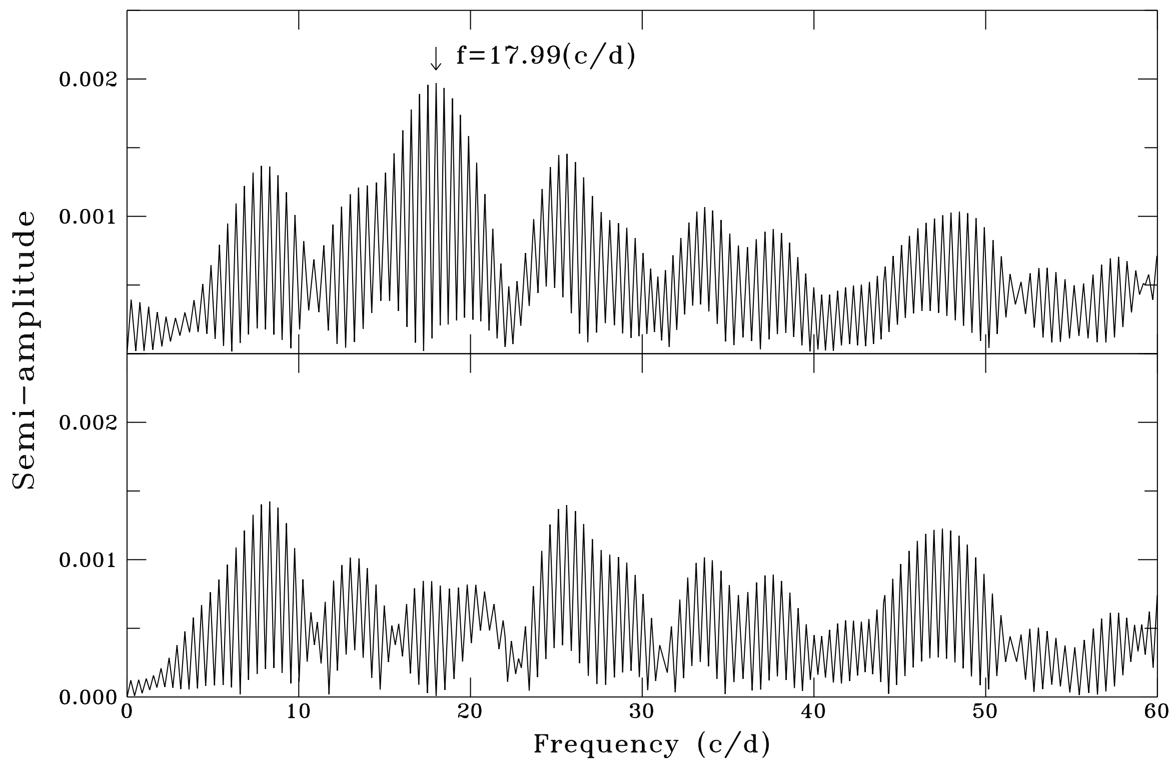

Figure 3. The amplitude DFT spectra

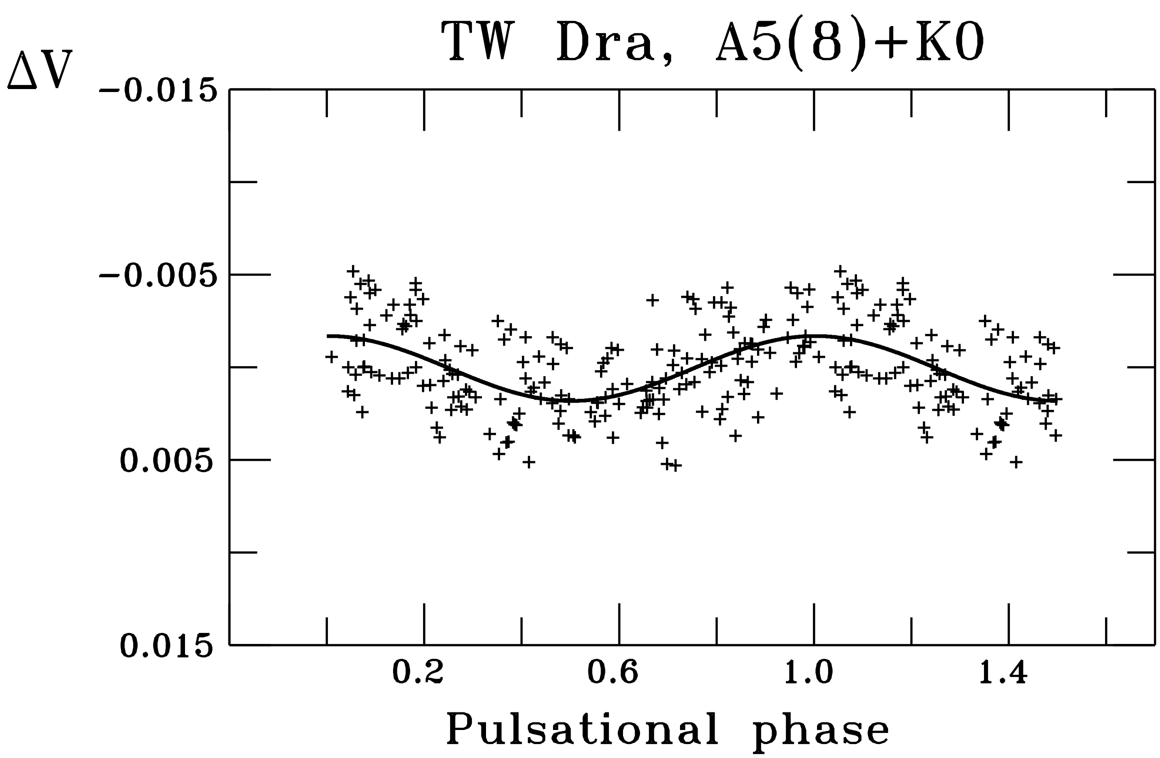

Figure 4. The phase curve folded with the period of $0\overset{\rm d}{.}0556$

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SUPEROUTBURST OBSERVATION OF AQ Eri: EVIDENCE FOR AN ANOMALOUS SUPERHUMP EXCESS?

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AQ Eri is one of the relatively bright SU UMa-type dwarf novae. Thorstensen et al. (1996) reported a spectroscopic orbital period ($P_{\rm orb}$) of $0\overset{\rm d}{.}06093$, which makes AQ Eri a member of SU UMa-type dwarf novae with the shortest orbital periods. Intermediate nature between usual SU UMa-type dwarf novae and extreme WZ Sge-type systems has been proposed for dwarf novae with such periods (cf. Nogami et al. 1996). However, only little is known about superhumps of AQ Eri. No observations of its superhumps have been reported since Kato (1991), who reported a superhump period ($P_{\rm SH}$) of $0\overset{\rm d}{.}06225$. Thorstensen et al. (1996) reported that this superhump period gives a fractional superhump excess ($P_{\rm SH}/P_{\rm orb} - 1$) acceptable for a dwarf nova of this orbital period. During the superoutburst in 1992 January, the author succeeded in taking another time-resolved CCD photometry, which is far superior in quality than in Kato (1991).

The observations were done on 1992 January 4 using a CCD camera (Thomson TH 7882, 576×384 pixels, on-chip 3×3 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (focal length = 4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 30 s. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based aperture photometry package developed by the author. A total of 430 high-quality images were obtained. The magnitudes of the object were measured relative to GSC 4758.334 ($V = 10.93$, $B - V = +1.24$), whose constancy during the run was confirmed using GSC 4758.622. The observation on following nights was unfortunately hindered by bad weather. Barycentric corrections to observed times were applied before the following analysis.

Figure 1 shows the resultant light curve. Three superhumps are clearly visible with a full amplitude of $0\overset{\rm m}{.}24$. This observation confirms the SU UMa-type nature of AQ Eri. Short-period oscillations (quasi-periodic oscillation; QPOs) became stronger around superhump minima. This feature was also observed in AK Cnc (Mennickent et al. 1996), another SU UMa-type star with a short $P_{\rm orb}$. This feature may be common to superhumps of short-period systems.

Period analysis using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978) has yield a superhump period of 0.0642 ± 0.0004 d, which is remarkably longer than the previously reported value of $0\overset{\rm d}{.}06225$. The fractional superhump excess is $5.4 \pm 0.7\%$, which is remarkably larger than the typical superhump excesses (1–3%) of short-period systems. The reason of this discrepancy is not well understood. The author has checked

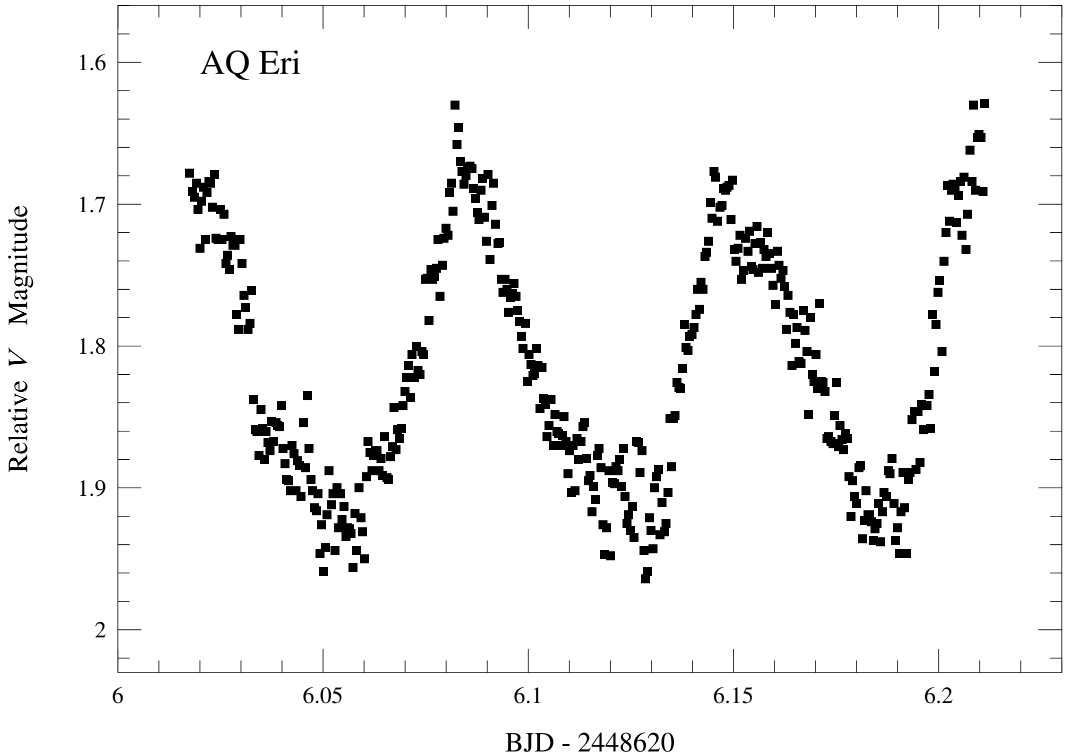

Figure 1. Light curve of AQ Eri on 1992 January 4

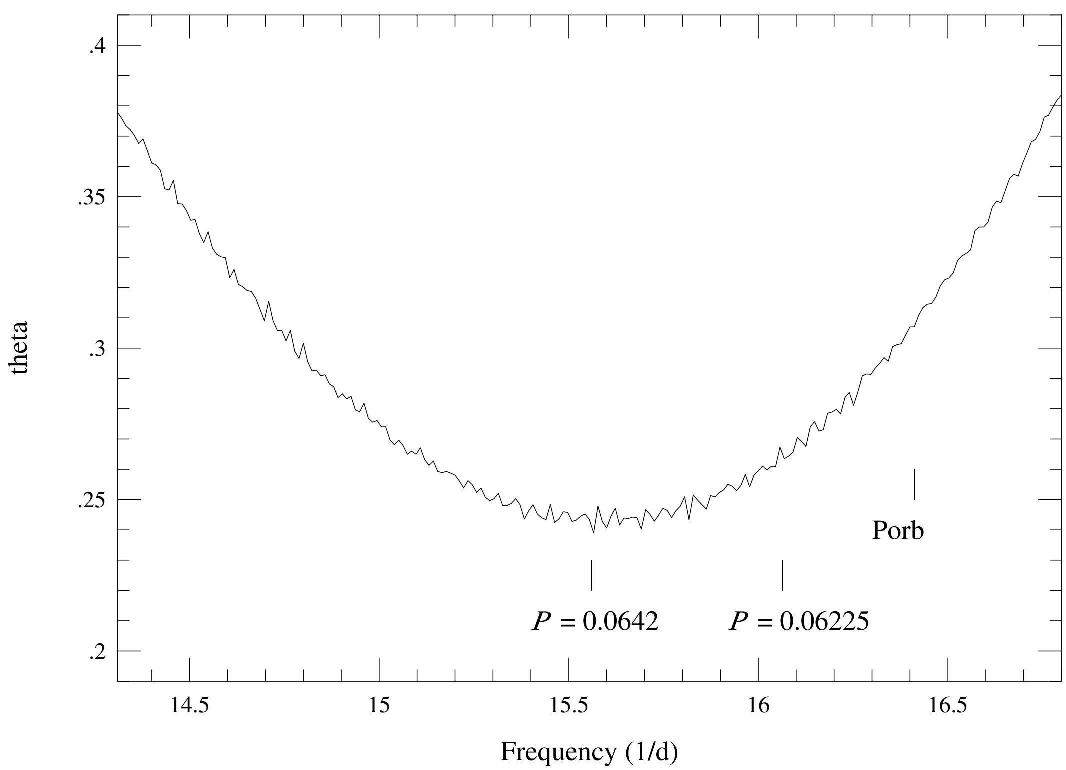

Figure 2. Periodogram of AQ Eri superhumps

the stability of the computer clock and recording system, and found no abnormalities. The seemingly abnormal period is thus most likely attributed to the superhump period itself. The relation between the observed P_{SH}, previously observed P_{SH} and P_{orb} is shown in Figure 2. Although it may be still possible AQ Eri has an intrinsically abnormally high fractional superhump excess, such a high superhump excess may have been a transient one. Future more extensive observations during superoutbursts are thus strongly encouraged.

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THE 1997 SUPEROUTBURST OF THE SU UMa-TYPE DWARF NOVA V2176 CYGNI

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This object was discovered as a new cataclysmic variable star (CV) by Hu et al. (1997) at $m_R = 13.3$ and 13.5 on 1997 August 28 and 31, respectively, during the BAO supernova survey, and identified with USNO A1.0 1425.09823278 ($\alpha = 18^h27^m\!\!.11^s\!\!.63$, $\delta = +54°17'51''\!\!.5$ (J2000.0), $m_r = 19.9$, $m_b = 20.3$). The spectrum they obtained on Aug. 31 showed Balmer absorption lines and weak HeI lines, typical features of CVs in outburst.

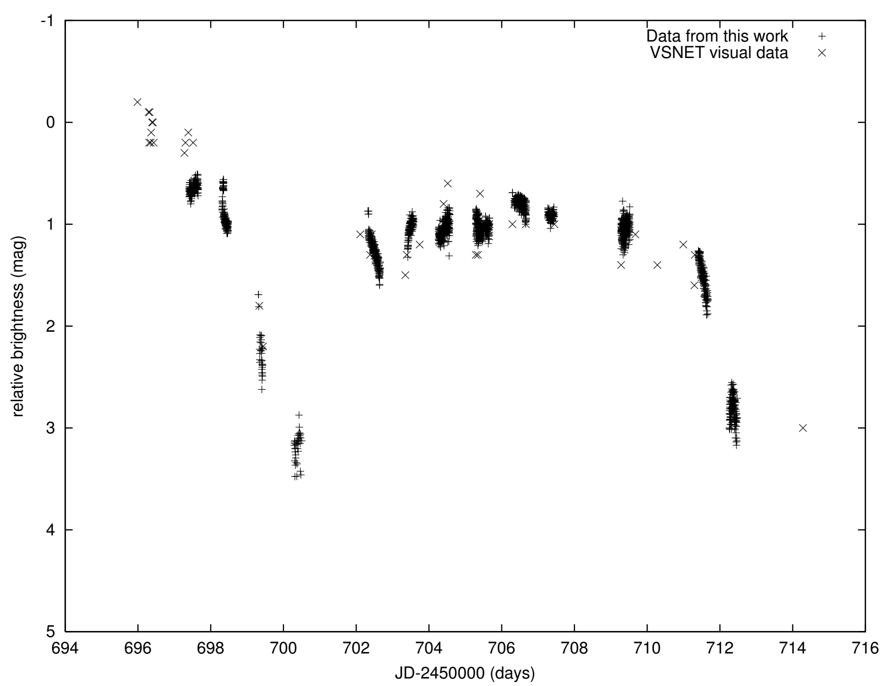

Figure 1. Overall light curve of V2176 Cygni during the 1997 superoutburst, derived from observations at N. Copernicus Observatory, CBA Belgium, CBA Denmark and combined with visual VSNET data

Table 1: Overview of the data. C means unfiltered CCD

JD_{start} 2450000 +	JD_{end}	Count	Filter	Station	JD_{start} 2450000 +	JD_{end}	Count	Filter	Station
697.408	697.654	192	C	Belgium	706.294	–	1	C	Denmark
698.315	698.482	121	C	Belgium	706.348	706.677	299	C	Belgium
698.331	698.355	16	C	Denmark	707.269	707.439	117	R	Brno
699.311	–	1	C	Denmark	709.282	709.424	97	R	Brno
699.320	699.425	31	R	Brno	709.282	709.439	124	C	Denmark
700.297	700.502	36	R	Brno	709.396	709.526	96	C	Belgium
702.051	702.164	70	V	Ouda	712.258	712.474	139	R	Brno
702.324	702.338	3	C	Denmark	710.280	710.450	100	C	Denmark
702.336	702.661	262	C	Belgium	710.905	710.999	110	V	Ouda
703.109	703.157	29	V	Ouda	711.000	711.136	82	V	Ouda
703.415	703.579	112	R	Brno	711.298	711.438	84	C	Denmark
704.263	704.572	257	R	Brno	711.405	711.671	196	C	Belgium
705.288	705.367	49	C	Denmark	714.283	–	1	C	Denmark
705.300	705.664	322	C	Belgium					

The discovery of the variable was relayed to the VSNET mailing list by Kato (1997), which allowed several CCD observers around the world to immediately start monitoring of this newly discovered object. Figure 1 shows the overall light curve obtained from data sets of N. Copernicus Observatory, CBA Belgium and CBA Denmark. Since dwarf novae change their colors during an outburst only a little, we could quite easily calibrate the different observation systems used in the aforementioned observatories, after which the global light curve of Figure 1 was constructed. This curve is in good agreement with the data set presented by visual observers (included in a plot) on VSNET (Kato 1997).

The Brno data were obtained with a 0.40-m Newtonian reflector and an SBIG ST-7 CCD camera with Kron–Cousins R-band filter. Images were dark-corrected and flat-fielded, prior to starting differential aperture photometry, using the package Munidos, which itself is based on Daophot II (http://munipack.astronomy.cz). No filter was applied on final data and only some images were omitted because of bad weather conditions.

The Ouda data were obtained with the 0.60-m reflector and a Thomson TH7882 CCD camera through a Johnson V filter. We reduced the Ouda frames using an aperture photometry package developed by T. Kato, after the standard corrections of debiasing and flat-fielding.

Time-resolved and differential (variable − comparison) CCD photometry of V2176 Cyg was done at CBA Belgium using a 0.35-m $f/6.3$ Schmidt–Cassegrain telescope, mounted on an AstroTechniek FM-98 German equatorial mount, and equipped with a SBIG ST-7 CCD camera (Kodak KAF-0400 CCD for imaging and Texas Instruments TC211 CCD for guiding). For a complete description of the CBA Belgium Observatory equipment and software, see (Vanmunster et al. 2000).

An important feature in the overall light curve of the 1997 superoutburst of V2176 Cygni is the dip, which is followed by a rebrightening. A very similar behavior was also observed in AL Com (Nogami et al. 1997). The light curve of the 1996 outburst of AL Com was interrupted by a dip, showing a rate of decline of about 1 mag d^{-1} (from visual observations). In the case of V2176 Cygni, the rate of decline is about 0.8 mag d^{-1} (from the overall light curve presented in Figure 1). AL Com also showed a small dip just after the first one. This feature was not clear in our overall data (due to bad weather conditions). The run at JD 2450702 shows a rapid fading of the system (see Figure 2) which was followed by rebrightening, observed on the next night (Figure 3). Of course we do not now if this was a real dip, because important data during that phase are missing, but we can suspect a similarity in the case of V 2176 Cyg too.

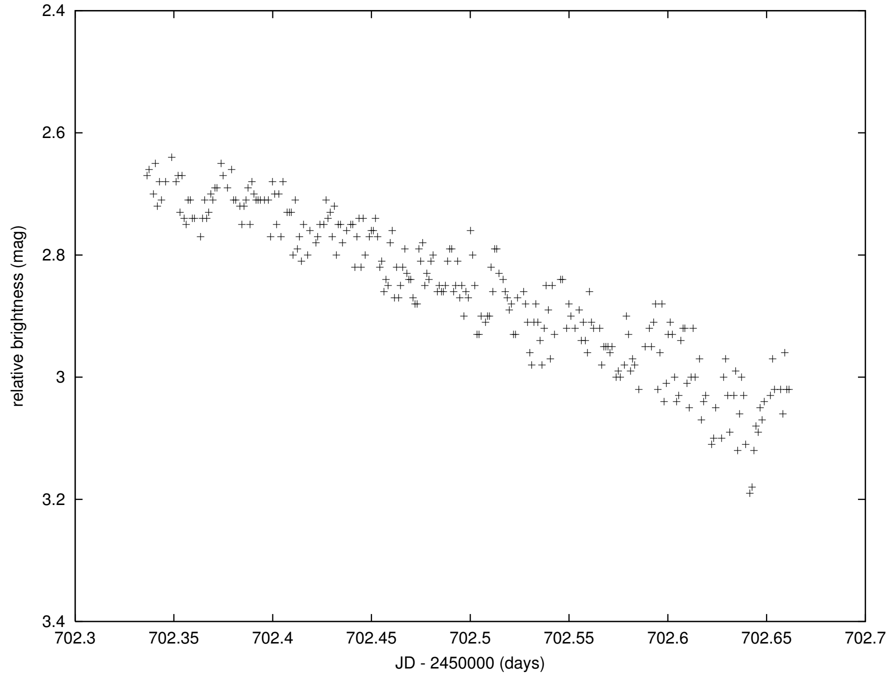

Figure 2. Rapid decline after first dip as observed at CBA Belgium

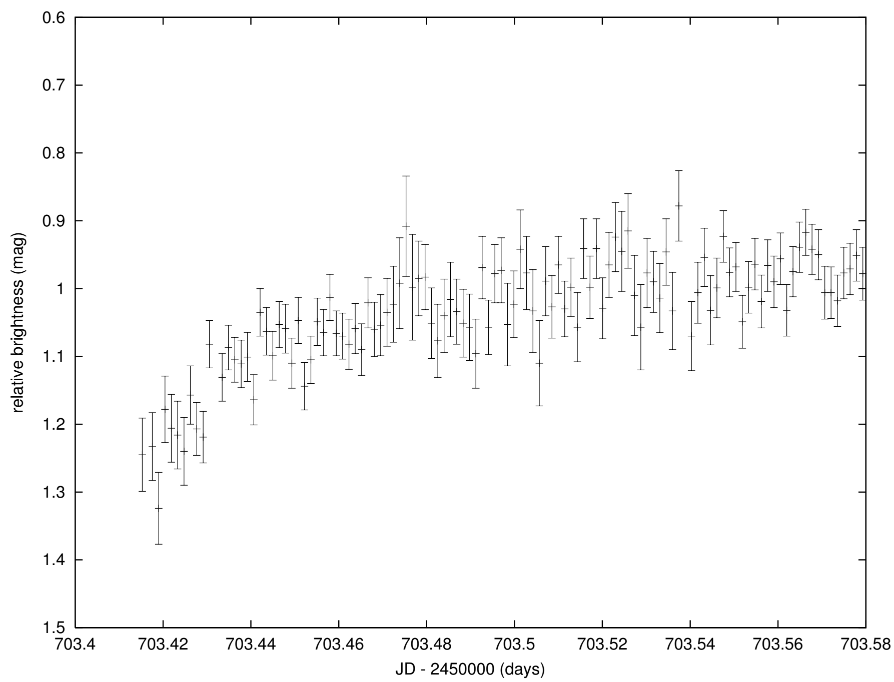

Figure 3. Rising from probable second dip mentioned in the text as observed at CBA Belgium

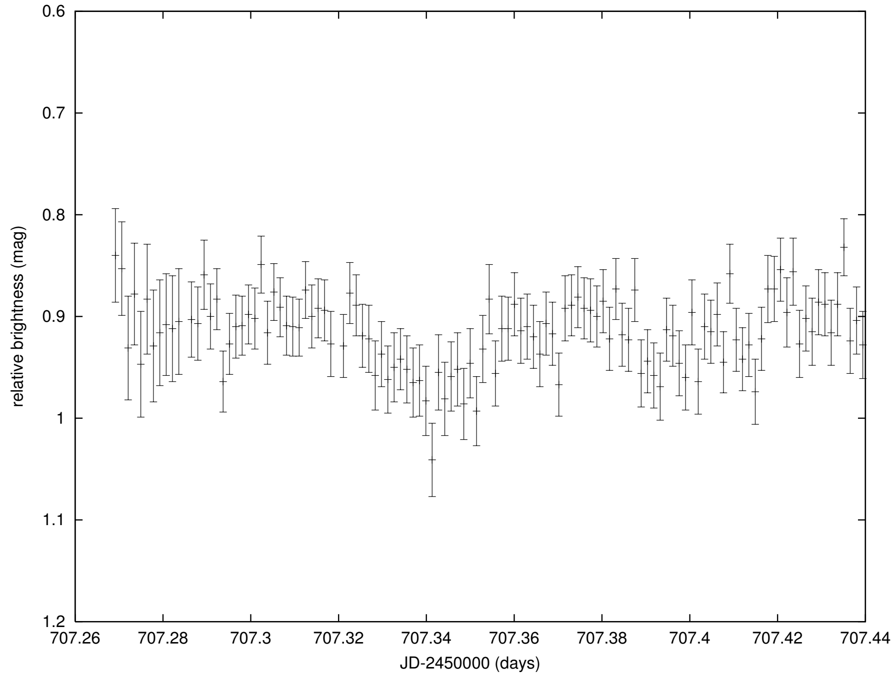

Figure 4. Light curve with superhumps from Brno observatory

During the V2176 Cyg outburst, superhumps were detected, allowing the classification of this system as an SU UMa-type dwarf nova. Using the PDM (Stellingwerf, 1978) technique, we derived a superhump period value $P = 0.056 \pm 0.003$ d using data presented at Figure 4. Founded period was in very good agreement with the one reported by Vanmunster (Vanmunster, 1997) as $P = 0.0561 \pm 0.0004$ d. Unfortunately, the data obtained at all stations were too noisy to detect possible variations in the superhump period value, over the course of the outburst. Evidently, this should be the subject of further observations during future outbursts.

Between 1997 and the beginning of 2001, no further optical activity of V2176 Cygni has been reported, despite intensive monitoring by various groups of observers around the world. We therefore suspect that the system has a very long baseline for superoutbursts. This is a typical footprint of WZ Sge type variables. Given the large outburst amplitude (about 7 magnitudes) and the long recurrence time, combined with the observed light curve modulations and the dip, V2176 Cygni seems to be a very likely WZ Sge type candidate. Needless to say that this object is a very interesting target for further systematic study.

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ON THE SUPERCYCLE LENGTH OF HS Vir

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HS Vir is a dwarf nova originally discovered as an ultraviolet excess object PG 1341-079, whose cataclysmic nature was subsequently identified by spectroscopy (Green et al. 1982, 1986). The first extensive photographic observations were done by Osminkin (1985), which revealed the existence of relatively frequent, short, faint outbursts, and the presence of a bright ($\sim 12^{\mathrm{m}}\!.8$) outburst. This outburst pattern, together with the likely orbital period of $0^{\mathrm{d}}\!.0836$ (or its alias) from radial-velocity study by Ringwald (1993), makes HS Vir a good candidate for an SU UMa-type dwarf nova. However, it took a relatively long time before the nature of the object was revealed. Kato et al. (1995) reported frequent short outbursts with a recurrence period of 8 d, but no apparent superoutburst was recorded. Kato et al. (1998) finally identified a superoutburst occurring in 1996 May. In spite of the long-term coverage, no additional superoutburst was observed. Kato et al. (1998) only concluded that the supercycle of HS Vir should be longer than 80 d. As discussed in Nogami et al. (1997), Kato et al. (2000) and also Kato et al. (1998), HS Vir has been proposed as an intermediate object between usual SU UMa-type dwarf novae and peculiar ER UMa stars (for a review, see Kato et al. 1999). Determination of supercycle of HS Vir thus has been a long-wanted job.

Since the identification as an SU UMa-type dwarf nova, this star has been monitored as a part of the VSNET Collaboration (http://www.kusastro.kyoto-u.ac.jp/vsnet/). The visual observations were done 32-cm (R.S.), 40-cm (A.P.), 20-cm (P.A.D.), 30-cm (H.I.) and 25-cm (M.S.) reflectors. The CCD observations were done using an Apogee AP-7 attached to a 25-cm telescope (S.K.). A V-band filter was used for the CCD observations. All observations used comparison stars calibrated in the V-band. Nightly averaged magnitudes for CCD observations were used for the following analysis. Three additional superoutbursts were recorded up to 2001 June. Table 1 lists the known of superoutbursts of HS Vir.

Table 1: Superoutbursts of HS Vir

JD maximum	peak magnitude	source
2450154	13.6	Kato et al. (1998)
2451316	13.4	this work
2451689	13.3	this work
2452058	13.3	this work

As is already evident from Table 1, there is a clear cycle of 371 d, determined from the recent three superoutbursts. The superoutburst detected by Kato et al. (1998) also approximately fits to this period. By assuming three supercycles between the first and second superoutbursts, the mean cycle length becomes 382 d. However, this value should be treated with caution since Kato et al. (1998) reported a change in the outburst characteristics in 1997. The best determined supercycle of HS Vir is thus 371 d or its n-th size. While available observations can reject periods shorter than 124 d (one-third of 371 d), the half period of 186 d cannot be excluded because of observational gaps around solar conjunctions. Since the period of 371 d is close to one year, the clear discrimination of these possibilities might be hard to achieve in the near future. We therefore consider on two possibilities: 186-d supercycle and 371-d supercycle. Figure 1 and 2 represent folded light curves by the two candidate periods of 186 d and 371 d, respectively. Only positive observations are plotted in order to avoid confusion.

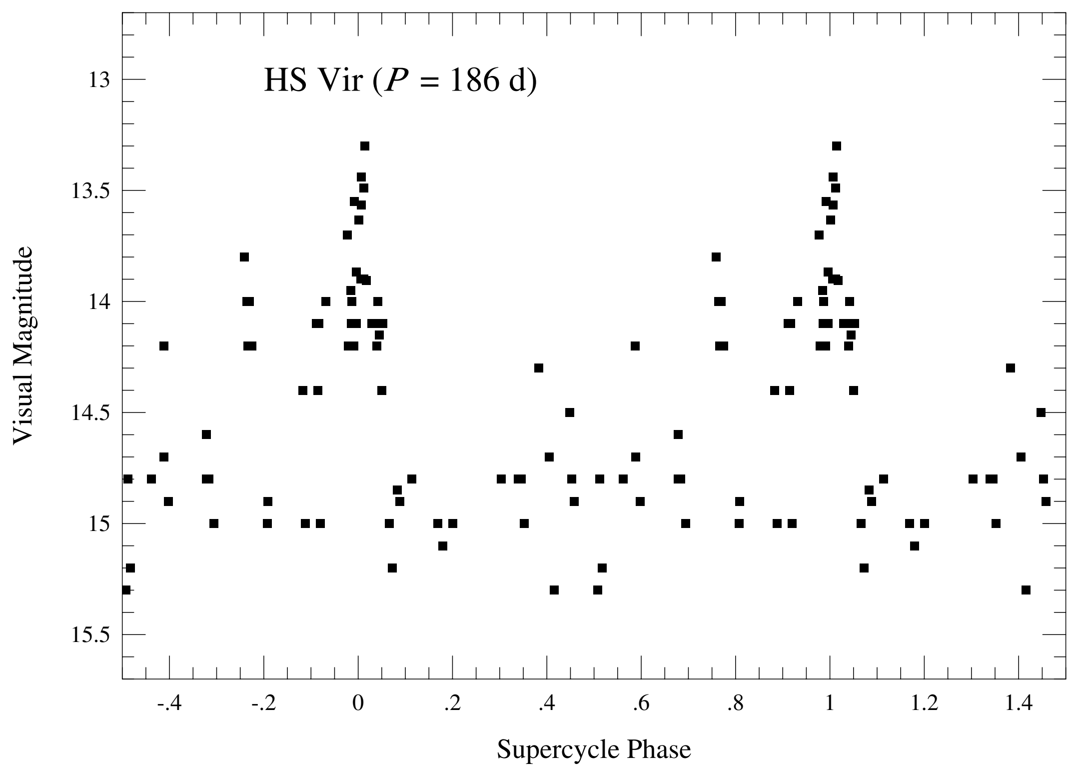

Figure 1. Light curve of HS Vir folded by a period of 186 d

Both figures are acceptable for a supercycle light curve of an SU UMa-type dwarf nova. Because normal outbursts are faint and short, many of them must have escaped from the

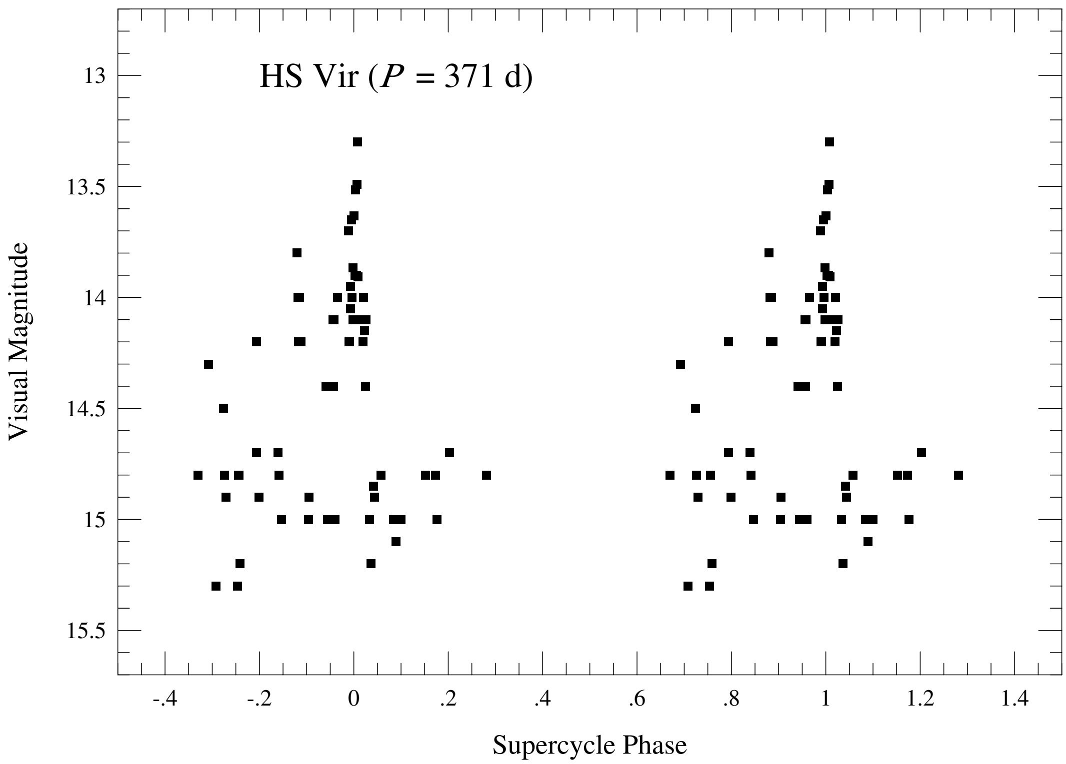

Figure 2. Light curve of HS Vir folded by a period of 371 d

present detection. Given the cycle length of 8 d (Kato et al. 1995) for normal outbursts, the number ratios of (normal outbursts)/(superoutbursts) become $\sim$ 23 and $\sim$ 46 for the periods of 186 d and 371 d, respectively. These values are rather large compared to most of SU UMa-type dwarf novae (e.g. Nogami et al. 1997). However, the latter large value is not perfectly exceptional, as WX Hyi is another example showing a large number ratio of (normal outbursts)/(superoutbursts). Given the long orbital period of $0\overset{d}{.}07692$ (Mennickent et al. 1999), HS Vir may be a system marginally unstable to the tidal instability, lying close to the border of SU UMa-type and SS Cyg-type dwarf novae.

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V1113 Cyg is an SU UMa-type dwarf nova, whose nature was revealed by Kato et al. (1996). In spite of its very usual appearance of superhumps and their development, Kato et al. (1996) discussed that V1113 Cyg has slightly different properties from those of other well-known SU UMa-type dwarf novae: the short recurrence time ($\sim$ 10 d) as inferred from the discovery observation by Hoffmeister (1966) contradicts with the large outburst amplitude ($\sim$ 6 mag). Kato et al. (1996) proposed the possible presence of active and inactive phases, but further observations were undoubtedly needed to draw a more definite conclusion. Since the discovery of its SU UMa-type nature, the object has been well monitored by visual observers, as a part of VSNET Collaboration (http://www.kusastro.kyoto-u.ac.jp/vsnet/). A total of 992 observations were reported between 1994 July 15 and 2001 May 31, the rate corresponding to one observation per 2.5 d. The number of positive detections was 149, corresponding to the outburst duty cycle of 15%. However, this value may have suffered some degree of bias, since not all observations were made irrespective of the outburst state. However, thanks to the dense coverage by these observations, the selection of outbursts and its classification can be almost always unambiguously done. The result is summarized in Table 1 and Figure 1.

As is always evident from the table, almost all superoutbursts were detected since 1994 July. The intervals of successive superoutbursts relatively strongly varied between 169 and 229 d (during the 404 d interval between JD 2451124 and 2451528, one superoutburst was likely to be missed), 189.8 d in average. A noteworthy feature is the low number ratio of (normal outbursts)/(superoutbursts). The total number of observed outbursts is 30, while 12 of them are superoutbursts. The number ratio suggests only two normal outbursts in each supercycle. This ratio is very low for an SU UMa-type dwarf nova with the short supercycle of 189.8 d (cf. Nogami et al. 1997). In order to estimate the possibility of missed outbursts, owing to the observational gaps, we applied Monte-Carlo simulations on actual observations. $\sim$ 50% of simulated normal outbursts were detected using the actual timings of observations. The reduced detectability is mainly caused by the observational gaps, and not by limiting magnitudes. Even though this detectability of normal outbursts would raise the number ratio to $\sim$ 4, this is still small for a system with a short supercycle.

We know another example, V503 Cyg, which normally shows only 2–3 normal outbursts in one 89-d supercycle (Harvey et al. 1995; Ishioka et al. 2001). There should be a still poorly understood mechanism common to these objects, which suppresses normal outburst while maintaining a high frequency of superoutbursts. A notable exception can be found

Table 1: Outbursts of V1113 Cyg

JD start	peak magnitude	duration (d)	type
2449597	13.3	15	super
2449826	13.5	> 4	super
2449893	13.9	3	normal
2449956	13.8	3	normal
2450025	13.4	11	super
2450203	13.6	> 8	super
2450280	13.8	2	normal
2450308	14.0	1[a]	normal
2450333	13.8	2	normal
2450372	13.4	> 6	super
2450420	13.9	1[a]	normal
2450546	13.9	11	super
2450689	13.8	2	normal
2450728	13.7	11	super
2450816	14.0	2	normal
2450929	13.9	> 8	super
2450956	15.2	1[a]	normal
2450999	14.4	1[a]	normal
2451037	14.8	2	normal
2451124	13.8	> 9	super
2451296	13.9	2	normal
2451367	14.5	2	normal
2451528	13.8	> 4	super
2451664	14.1	3	normal
2451716	13.5	12	super
2451746	14.7	2	normal
2451818	14.9	2	normal
2451839	13.9	3	normal
2451902	13.7	> 2	super?
2452025	14.0	3	normal

[a] single observation

after the JD 2451716 superoutburst. The shortest interval between normal outburst was 21 d. Since the object was equally frequently and deeply monitored in the preceding season, this increased detections may actually reflect the increased activity of this star. This phenomenon, if confirmed, would provide a support to the idea of active and inactive phases, proposed by Kato et al. (1996).

The authors are grateful to VSNET members, especially to Gary Poyner, Tonny Vanmunster, Maciej Reszelski, Eric Broens, Hazel McGee, Jochen Pietz, Mike Simonsen, Lasse T. Jensen and a number of observers for providing crucial observations.

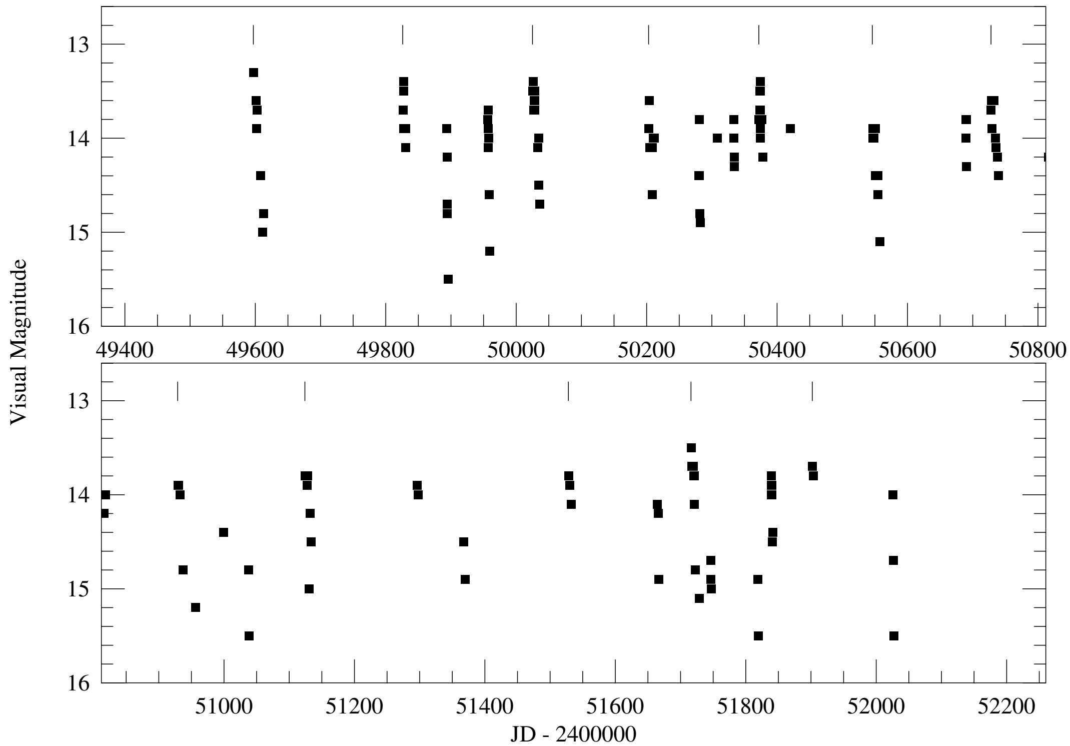

Figure 1. Overall light curve of V1113 Cyg. Superoutbursts are marked with ticks. Upper limit observations are not plotted for simplicity

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THE PERIOD BEHAVIOUR OF THE ECLIPSING BINARY LD 328

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LD 328 (GSC 3256-0458, $00^{\rm h}26^{\rm m}49\overset{\rm s}{.}09$, $+49^\circ40'35\overset{''}{.}7$ (USNO A2.0)), was discovered to be variable by Dahlmark (1999) during a photographic survey of the northern Milky Way. Dahlmark suggested that the star was an eclipsing binary with an amplitude of 1.0 mag at V, but was unable to find the period. The period has now been determined from Dahlmark's data and extensive visual observations, and its behaviour over most of the last century has been followed using further observations from the Harvard plate archive, and recent CCD observations.

LD 328 has been examined on plates of the Harvard College Observatory archive RH Patrol Series (1928–1952), limiting magnitude 14-15, Damon Patrol Series (1965–1990), limiting magnitude 14–15, and AC Series (1898–1954), limiting magnitude 12, although some are much fainter. The plates are blue sensitive and magnitudes of LD 328 have been estimated visually by Guilbault on 171 RH, 119 Damon and 27 AC Series plates against comparison stars with magnitudes from USNO A2.0 (Monet et al. 1998). The Harvard data provide 15 times of minima, although one timing is inconsistent with the others. Dahlmark's (1999) observations were made between 1967 and 1999 using Kodak 103aD + GG11 and TechPan 4415 + GG495 emulsion/filter combinations, giving approximately $m_{\rm pv}$ magnitudes, which were determined by visual comparison against nearby stars with GSC magnitudes. The light curve is previously unpublished and provides six times of minima. An extensive series of visual observations by Guilbault and Kinnunen, which initially allowed the period to be resolved, contain eleven times of minima, although all but the last of these are based on single observations. Recent CCD observations by Hager, Henden, James, Kaiser and Lubcke have provided a complete light curve at V, and most of the primary minimum in the red (unfiltered CCD). These observations provide accurate

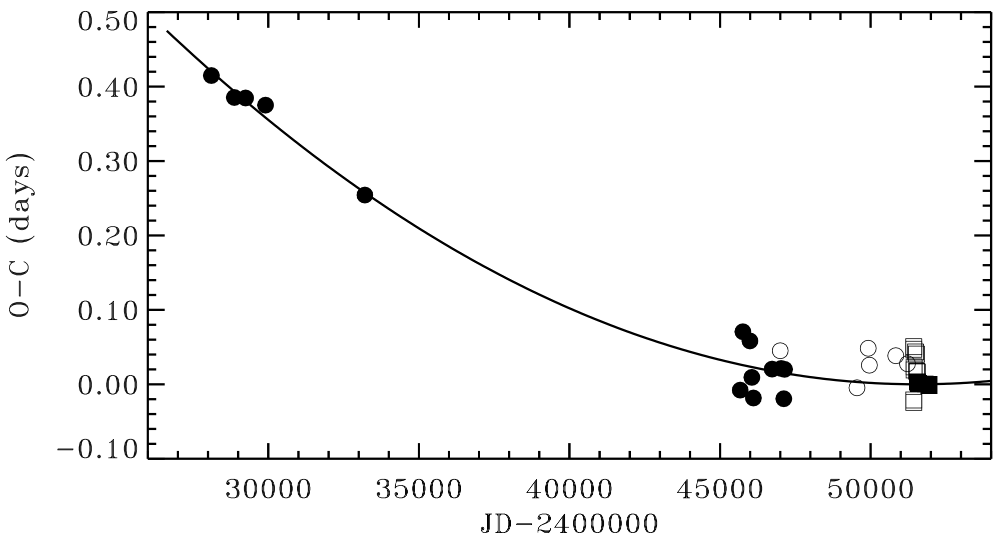

Figure 1. The $O-C$ diagram of the times of minima using the linear terms of the ephemeris, with the quadratic fit shown. The Harvard data are shown by filled circles, Dahlmark's data, open circles, visual data, open squares and CCD data, filled squares

timings of three primary minima and one secondary minimum, and are described in more detail by Lloyd et al. (2001).

All the times of minima have been collected in Table 1 and the $O-C$ diagram is shown in Figure 1. The residuals show clear curvature indicating a changing period. In fitting a parabolic ephemeris it has been necessary to give the CCD observations high weights to force the solution through them. Also, all but the first of Dahlmark's times of minima have been excluded from the solution as they appear to be systematically high, although it is not clear if this has any significance. The visual timings have also not been used as they are relatively recent and are much less reliable than the CCD timings. The adopted parabolic ephemeris is

$$\mathrm{HJD_I} = 2451559.2824(29) + 1.0838485(14) \times E + 9.0(7) \times 10^{-10} \times E^2$$

and is subject to small variations depending on the weights used. The $O-C$ diagram using the linear terms of the ephemeris in shown in Figure 1. The phase diagrams of the Harvard data for 1928–1951 and 1975–1989 are shown in Figure 2, and are constructed using a changing period. The linearized phase diagram of Dahlmark's data is shown in Figure 3.

Photometric modelling of the CCD observations by Lloyd et al. (2001) suggests that the system is a relatively cool Algol binary containing components of spectral type late A and late G, with the secondary probably filling its Roche lobe. The rate of period change, $\dot{P}/P = 5.6 \times 10^{-7}\ \mathrm{yr}^{-1}$ is not unlike other Algol systems, and suggests that there is continuing mass transfer in the system.

The authors would like to thank Dr. Martha Hazen, Curator of the Astronomical Photograph Collection of the Harvard College Observatory, for access to the plates of this and other variable stars.

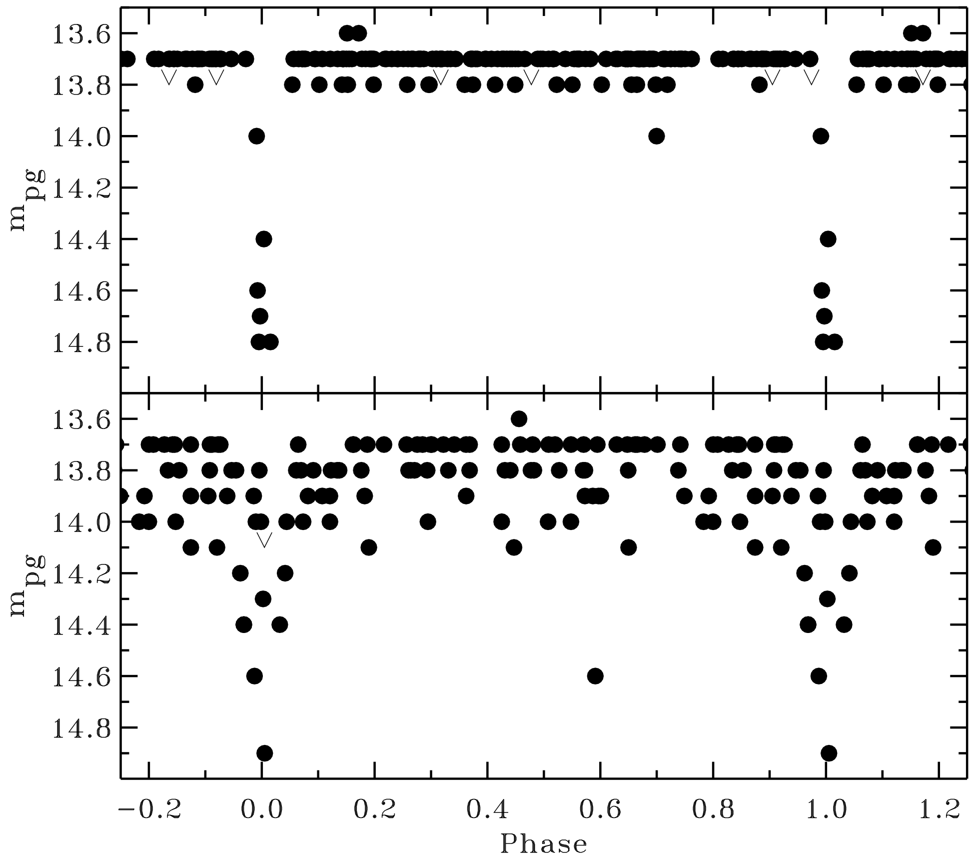

Figure 2. The linearized phase diagram of the early Harvard data, 1928–1951 (top), and the later Harvard data, 1975–1989 (bottom) folded using the parabolic ephemeris

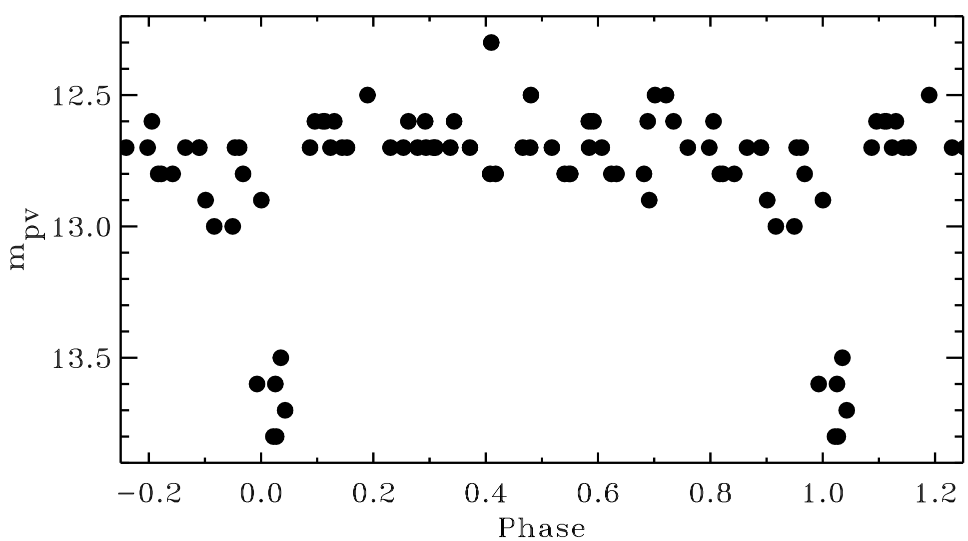

Figure 3. The linearized phase diagram of Dahlmark's data

Table 1: Times of minima of LD 328

HJD	Cycle	$O-C$	band	Observer
2428110.635	−21635	0.4149	pg	Guilbault
2428872.551	−20932	0.3854	pg	Guilbault
2429246.478	−20587	0.3847	pg	Guilbault
2429907.616	−19977	0.3751	pg	Guilbault
2433206.730	−16933	0.2543	pg	Guilbault
2445668.558	−5435	−0.0078	pg	Guilbault
2445757.512	−5353	0.0706	pg	Guilbault
2445991.611	−5137	0.0583	pg	Guilbault
2446055.509	−5078	0.0093	pg	Guilbault
2446107.506	−5030	−0.0184	pg	Guilbault
2446728.590	−4457	0.0204	pg	Guilbault
2446998.493	−4208	0.0451	pv	Dahlmark
2447028.817	−4180	0.0213	pg	Guilbault
2447116.568	−4099	−0.0194	pg	Guilbault
2447141.536	−4076	0.0201	pg	Guilbault
2447446.731	−3794	−0.4302	pg	Guilbault
2449546.571	−1857	−0.0047	pv	Dahlmark
2449919.468	−1513	0.0484	pv	Dahlmark
2449957.380	−1478	0.0257	pv	Dahlmark
2450835.310	−668	0.0384	pv	Dahlmark
2451223.317	−310	0.0276	pv	Dahlmark
2451430.355	−119	0.0506	vis	Kinnunen
2451431.4354	−118	0.0471	vis	Guilbault
2451432.4479	−117	−0.0242	vis	Guilbault
2451432.451	−117	−0.0211	vis	Kinnunen
2451443.3299	−107	0.0193	vis	Guilbault
2451443.334	−107	0.0234	vis	Kinnunen
2451493.211	−61	0.0434	vis	Kinnunen
2451522.4722	−34	0.0406	vis	Guilbault
2451525.7007	−31	0.0176	vis	Guilbault
2451549.5444	−9	0.0166	vis	Guilbault
2451559.2854	0	0.0034	ccd	James
2451585.2977	24	0.0014	ccd	James
2451821.574	242	0.0003	vis	Guilbault
2451931.5829†	343	−0.0015	V	Henden
2451937.5451	349	−0.0004	V	Lubcke
2451937.5456	349	0.0001	V	Kaiser

†: Secondary minimum

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Monet, D., Bird, A., Canzian, B., Dahn, C., Guetter, H., Harris, H., Henden, A., Levine, S., Luginbuhl, C., Monet, A.K.B., Rhodes, A., Riepe, B., Sell, S., Stone, R., Vrba, F., Walker, R., 1998, The USNO-A2.0 Catalogue

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THE NATURE OF THE ECLIPSING BINARY LD 328

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LD 328 (GSC 3256-0458, $00^{\rm h}26^{\rm m}49\overset{\rm s}{.}09$, $+49^\circ40'35\overset{''}{.}7$ (USNO A2.0)) was discovered as an eclipsing binary by Dahlmark (1999). An analysis of the historical photographic observations, Dahlmark's data, and recent visual and CCD observations shows that the star is an Algol variable with a period of $1\overset{\rm d}{.}0838485$, increasing at, $\dot{P}/P = 5.6\times10^{-7}$ yr^{-1} (Lloyd et al. 2001). In this paper the CCD observations are described in more detail and are used to model the system.

The CCD observations have been calibrated using a comparison sequence derived from $BV(RI)_{\rm C}$ observations from the USNO Flagstaff Station 1.0-m telescope and a SITe/Tektronix 1024 × 1024 CCD (see Table 1). LD 328 was observed at two phases which provide multi-colour photometry at secondary eclipse and out of eclipse (see Table 2). The comparison stars were calibrated on one photometric night and have an estimated zero point error of $0\overset{\rm m}{.}02$. Additional field photometry is available at

`ftp://ftp.nofs.navy.mil/pub/outgoing/aah/sequence/ld328.dat`.

Further CCD observations in V only have been made by Hager, Lubcke and Kaiser using 0.25-m, 0.28-m and 0.35-m SCTs respectively, all equipped with ST-9E CCDs, and together with the Flagstaff observations they cover the complete light curve. Observations around primary eclipse were also made by James using an unfiltered Starlight Xpress SX CCD on a 0.30-m telescope. These have been calibrated using the R magnitudes of the comparison stars. The light curves in V and R are shown in Figures 1 and 2 respectively, using the current period given above

Very little is known about LD 328. There is no spectral type available and the only accurate photometry is that presented here. It is possible to estimate the unreddened colours of the primary from the $B-V$, $V-R_{\rm C}$ and $R-I_{\rm C}$ colours derived at secondary minimum, assuming that it lies on the main sequence, and that the secondary component makes no significant contribution at this phase. Values for the unreddened main sequence have been taken from AQ4 (Cox 1999). The contribution of the secondary is obviously small as the star is only slightly bluer at secondary minimum compared to the out of

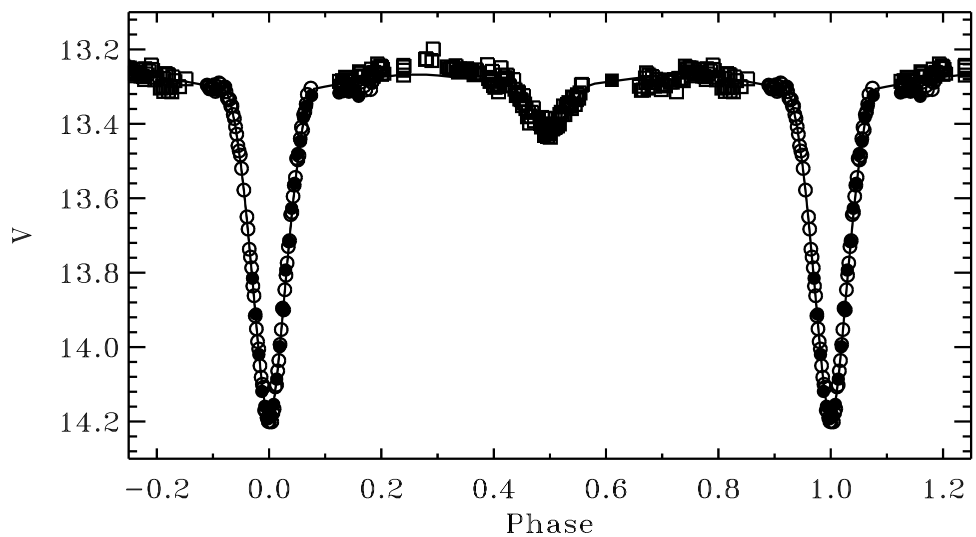

Figure 1. The phase diagram of the CCD V-band data showing the individual observations of Lubcke (filled circles), Kaiser (open circles), Henden (filled squares) and Hager (open squares). The modelled light curve has been over plotted

eclipse colours. Unfortunately the unreddened colours are poorly constrained and are consistent with main-sequence stars of spectral type A or F. Any contribution from the secondary will tend to make the primary appear of a later spectral type.

The V-band light curve of the system has been modelled using the LIGHT2 code (see Hill et al. 1989). A grid of models has been calculated covering a range of temperatures for the primary component, $6\,500 < T_1 < 15\,000$ K corresponding approximately to spectral types F5 to B5, and a range of mass ratios, $0.2 < q < 1.0$. For each model the program has solved for the relative radii of both components, R_1/a, R_2/a, the temperature of the secondary, T_2 and the inclination, i. A series of models was also run with the secondary radius, R_2/a, fixed at the Roche lobe radius, and the results are collected in Table 3.

The relative radii and the inclination are similar for all the solutions and they all produce very similar fits to the light curve, so there is no clearly preferred solution. For the smallest mass ratio, $q = 0.2$, the solutions with the secondary radius fixed or floating are essentially identical, but for larger mass ratios the secondary lies within its Roche

Table 1: Comparison star photometry near LD 328

Star	RA (2000) Dec	V	$B-V$	$V-R_C$	$R-I_C$
GSC3256-0691	$0^h27^m02^s.28$ +49°38arcm49″.8	12.486	0.552	0.327	0.341
GSC3256-0138	0 27 12.08 +49 43 06.6	13.511	0.533	0.332	0.340
GSC3256-0274	0 26 44.72 +49 45 59.6	12.736	0.542	0.331	0.328

Table 2: Multi-colour photometry of LD 328

HJD	Phase	V	$B-V$	$V-R_C$	$R-I_C$
2451930.6207	0.611	13.283	0.523	0.336	0.342
2451931.5851	0.501	13.428	0.478	0.308	0.316

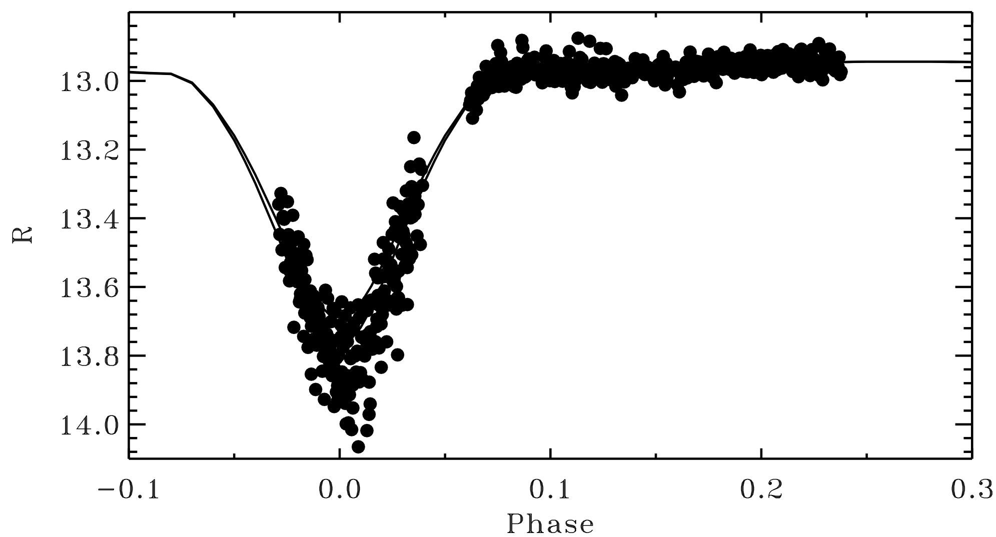

Figure 2. The unfiltered CCD observations around primary eclipse calibrated using the comparison star R magnitudes, with the modelled R_C and I_C light curves over plotted

lobe. For these, when the secondary radius is fixed at the Roche lobe radius, the fits to the data are only marginally poorer, but the solutions produce much smaller primaries and cooler secondaries.

Table 3: Photometric model of LD 328

T_1^*	T_2	R_1/a	R_2/a	i	q	$R_1/R_\odot$
15 000	8 200	0.23	0.26	81	1.0	2.4
15 000	8 400	0.22	0.26	80	0.5	2.1
15 000	7 700	0.16	0.30†	77	0.5	1.5
15 000	8 300	0.23	0.23†	82	0.2	2.0
10 000	6 200	0.23	0.26	80	1.0	1.9
10 000	6 300	0.23	0.25	81	0.5	1.7
10 000	5 800	0.16	0.30†	76	0.5	1.2
10 000	6 300	0.23	0.23†	81	0.2	1.6
8 000	5 200	0.24	0.25	81	1.0	1.7
8 000	5 400	0.24	0.25	81	0.5	1.5
8 000	4 900	0.17	0.30†	75	0.5	1.1
8 000	5 600	0.24	0.23†	82	0.2	1.4
6 500	4 600	0.22	0.26	80	1.0	1.3
6 500	4 600	0.25	0.24	81	0.5	1.4
6 500	4 300	0.17	0.30†	75	0.5	0.9
6 500	4 800	0.24	0.23†	82	0.2	1.2

* T_1 fixed; † R_2/a fixed at the Roche lobe radius

The models can also be used to estimate the change in colour with phase for comparison with the observed values (Table 2). Unfortunately there is a lack of consistency which makes it difficult to draw any firm conclusions. The agreement tends to be better with the cooler, lower mass ratio solutions, but it is still not as good as might be expected.

The relative radii, R_1/a, have been converted to absolute values by adopting consistent values of M_1 and T_1 for main-sequence stars. For the higher mass ratios the radii derived in this way are too small for the type of star assumed. Solutions with R_2/a fixed are even less consistent with the spectral type. A consistent set of values for the mass and radius occur for a primary of spectral type later than A7, ($T_1 < 8\,000$ K) making the secondary a low-mass, late G- or K-type star. The secondary is probably filling its Roche lobe, as the photometric solutions, the colours and the increasing period, all point in this direction.

In conclusion, LD 328 appears to be a relatively cool Algol binary with the secondary filling its Roche lobe. Much of the uncertainty in the photometric model would evaporate with a good spectral classification. LD 328 is potentially a very useful system as it is has relatively deep eclipses and a well determined rate of period change, and would benefit from a more detailed photometric and spectroscopic study.

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EF CANCRI: A NEW RRc STAR

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EF Cnc (= WR 100 = AN 2.1954 = NSV 4187 = GSC 1942.1380; $\alpha = 08^{\rm h}40^{\rm m}39^{\rm s}$, $\delta = +23^\circ15'51''$ [J2000]) was included in the NSV catalogue as a suspected rapid variable with a range of $10\overset{\rm m}{.}7$–$11\overset{\rm m}{.}9$ (pg) based on a study by Kippenhahn (1955). Further observations were made visually by Locher (1983) over 17 nights in February and March 1983. He found that the amplitude is smaller than in the NSV catalogue and determined the type of variability to be that of a W UMa type star with a period of $0\overset{\rm d}{.}5912$. A lot of the visual minima of EF Cnc in the BAV database come from that time.

EF Cnc was chosen for CCD monitoring on the basis of the PROSPEKTOR catalogue which contains eclipsing binaries lacking precise elements in the literature (Haltuf 2001). We obtained a total of 1171 CCD frames of EF Cnc on four nights (2001 February 14/15 and 16/17, April 5/6 and May 10/11) using an SBIG ST-7 CCD camera and Johnson V filter attached to the 0.4-m Newtonian telescope of the Nicholas Copernicus Observatory and Planetarium in Brno, Czech Republic. All exposures were 60 seconds in duration. GSC 1942.2816 ($V = 13\overset{\rm m}{.}06$) was used as the comparison star and its constancy up to $0\overset{\rm m}{.}05$ was checked by using the stars GSC 1942.2271 ($V = 12\overset{\rm m}{.}33$) and GSC 1942.1620 ($V = 13\overset{\rm m}{.}83$). Magnitudes of comparison and check stars were obtained using the nearby GSPC sequences P368 and P367 (Lasker et al. 1988); the errors of the zero-points are thought to be up to $0\overset{\rm m}{.}1$. The frames were processed using the package MUNIDOS 2.11 (Hroch & Novák 2000). All data are available from the authors upon request.

After close inspection of the light curves it was realised that it is impossible to confirm the eclipsing binary nature of EF Cnc. Assuming an asymmetric light curve ($\Delta\phi_{\rm rise} = 0.41$), a small hump just before the main maximum and the periodicity of variability, we conclude that EF Cnc belongs to the RRc stars. EF Cnc varies between $11\overset{\rm m}{.}18$ and $11\overset{\rm m}{.}73$ in V band. We determined three maxima seen in Table 1. Past maxima are shown in Table 2. All maxima by Locher (1983) in Table 2 are visual minima recalculated to maxima using formula Max = Min+0.41P. The only maximum by B. Krobusek in Table 2 was made with unfiltered CCD. Our phased light curve according to our ephemeris (see below) is in Figure 1.

We obtained approximate value of period using visual minima from the BAV database and one CCD maximum observed by Bruce Krobusek (NY, USA). The period change, most probably period decrease, is occurring in EF Cnc. Unfortunately, due to the scarcity

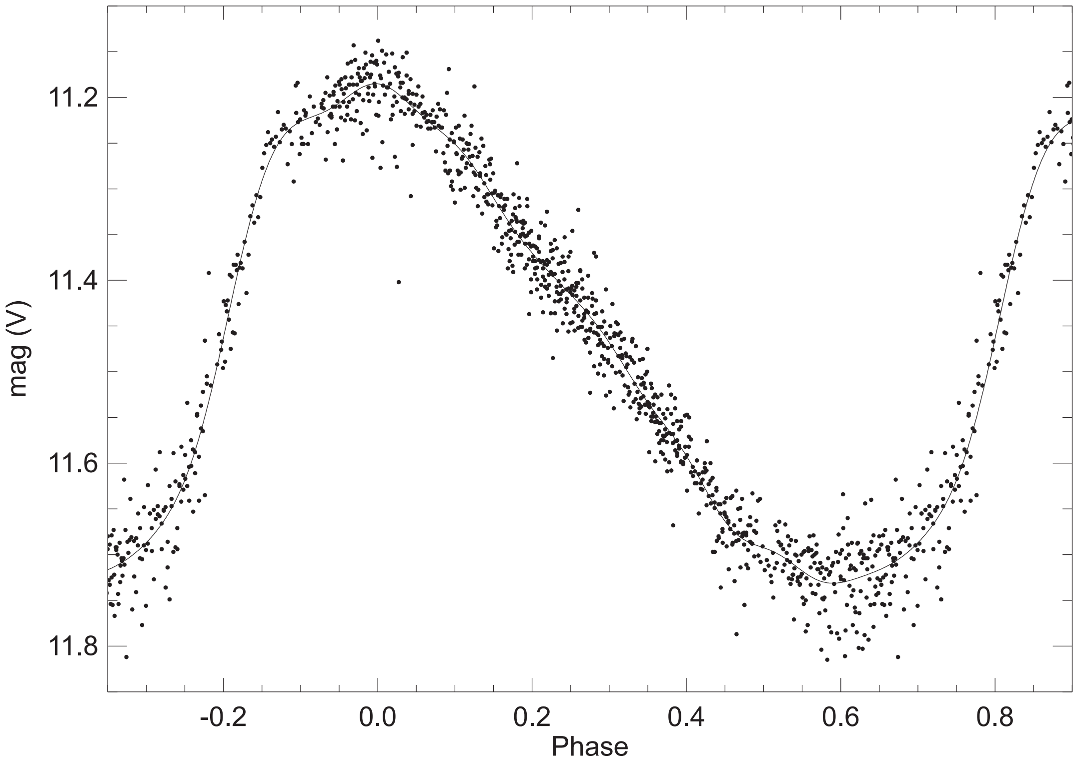

Figure 1. Phased V light curve of EF Cnc (small circles) and 10th order Fourier fit (solid line). Higher scatter both in maximum and minimum is due to instrumental effects

of observations we are not able to give any detailed analysis. Thus, we determined the following ephemerides using only our three times of maxima:

$$\begin{array}{l} \text{Max} = \text{HJD } 2451955.529 + 0.2956885 \times E. \\ \qquad\qquad\qquad\qquad \pm 0.004 \ \pm 0.0000036 \end{array} \tag{1}$$

We have made a standard 10th order Fourier decomposition of the light curve as described for example by Kaluzny et al. (2000). The fit is shown along with normal data in Figure 1. Residuals of the fit are on the $0\overset{m}{.}03$ level. Fourier and physical parameters with corresponding errors (from standard error propagation law) obtained using the equations of Simon & Clement (1993) are presented in Table 3. Physical parameters place EF Cnc near the blue edge of the first overtone instability strip of Kolláth et al. (2000).

Acknowledgement. We acknowledge overall support and use of telescope with CCD camera of the Nicholas Copernicus Observatory and Planetarium. We would like to thank L. Brát, F. Hroch, L. Král and R. Novák for software support and J. Greaves for assistance with the correction of the English manuscript. We are grateful to F. Agerer of

Table 1: Our maxima timings of EF Cnc according to the ephemeris (2)

Hel. JD	Error	Epoch	$O-C$
2451955.529	0.004	0	0.000
2451957.302	0.004	6	−0.001
2452040.392	0.004	287	0.000

Table 2: Past maxima of EF Cnc

Hel. JD	Observer	Hel. JD	Observer
2445379.449	K. Locher	2445694.471	K. Locher
2445382.410	"	2445697.706	"
2445383.560	"	2445698.595	"
2445384.453	"	2445700.666	"
2445384.740	"	2445702.711	"
2445385.631	"	2445710.733	"
2445387.695	"	2445711.628	"
2445388.587	"	2445730.525	"
2445397.473	"	2445764.549	"
2445399.530	"	2445765.440	"
2445401.620	"	2445768.673	"
2445402.493	"	2445782.590	"
2445406.636	"	2445783.482	"
2445407.497	"	2445785.536	"
2445428.520	"	2445822.489	"
2445430.568	"	2446032.801	"
2445436.542	"	2446033.698	"
2445437.407	"	2446054.710	"
2445460.476	"	2446134.525	"
2445592.716	"	2446145.493	"
2445594.755	"	2446148.459	"
2445617.816	"	2446163.521	"
2445660.687	"	2446166.509	"
2445670.765	"	2446168.560	"
2445680.529	"	2446352.804	"
2445686.747	"	2446376.786	"
2445693.850	"	2450515.821	B. Krobusek

Table 3: Fourier and physical parameters of EF Cnc

	Value	Error
A_1	0.268	0.001
R_{21}	0.209	0.005
R_{31}	0.075	0.005
R_{41}	0.057	0.005
ϕ_{21}	3.066	0.028
ϕ_{31}	5.858	0.071
ϕ_{41}	3.220	0.094
Mass	0.655	0.012
$\log L$	1.702	0.004
$T_{\rm eff}$	7356	29
Y	0.272	0.005

BAV for providing minima from the BAV database and to B. Krobusek for providing his CCD observations, which helped us to specify our guesses about long term period.

This paper is a result of cooperation of the Czech observatories and astronomers working in the observing programmes of the Czech Astronomical Society, namely B.R.N.O. (http://var.astro.cz/brno/) and MEDÚZA (http://www.meduza.org/).

This work made use of the SIMBAD database, operated at CDS, Strasbourg, France. The NASA ADS Abstract Service was used to access data and references.

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COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 5114

Konkoly Observatory
Budapest
12 June 2001

HU ISSN 0374 – 0676

GSC 0867.0545: A NEW RR LYRAE VARIABLE

(BAV MITTEILUNGEN NO. 136)

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Name of the object:
GSC 0867.0545

Equatorial coordinates:	**Equinox:**
R.A.= $11^h45^m45\overset{s}{.}5$ **DEC.=** $11°52'08''$	2000

Observatory and telescope:
W. Moschner: Private observatory, 32-cm Ritchey–Chrétien telescope; K. Bernhard: Private observatory, 20-cm Schmidt–Cassegrain telescope

Detector:	W. Moschner: SBIG ST9 camera; K. Bernhard: Starlight Xpress SX camera

Filter(s):	None

Comparison star(s):	GSC 0867.0034, $V \approx 12\overset{m}{.}8$

Check star(s):	GSC 0867.0289

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	RRab

Remarks:

The variability of GSC 0867.0545 has been found as part of a programme to discover and classify new variables using CCD observations of selected fields on the edge of the northern Milky Way (eg. Bernhard & Lloyd 2000). Additional observations were performed on 5 nights between January and February 2001 (W. Moschner, P. Frank) and 7 nights between March and May 2001 (K. Bernhard). This star has previously been referred to as Brh V44 (Bernhard 2000, 2001, Moschner 2001). The ephemeris was calculated using the "Phase Dispersion Minimization" method:

$$\begin{array}{ll}\mathrm{Max} = \mathrm{HJD}\ 2451956.489 + 0\overset{\mathrm{d}}{.}67939 \times E. \\ \qquad\qquad\qquad\qquad\quad \pm 5 \qquad\quad \pm 6\end{array} \tag{1}$$

Acknowledgements:

This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France.

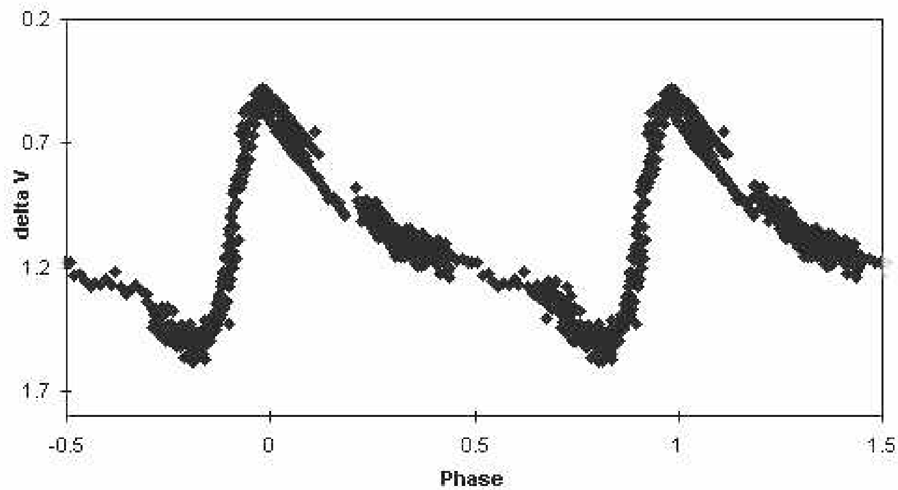

Figure 1. Differential light curve of GSC 0867.0545

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http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-newvar/msg00427.html
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COMMISSIONS 27 AND 42 OF THE IAU
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Number 5115

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Budapest
12 June 2001

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NSV 15563 IS A NEW CLASSICAL CEPHEID

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Name of the object:
NSV 15563 = Yarikov V6 = SVS 2683 = TYC2 4055 1349 1 = GSC 4055.1349

Equatorial coordinates:	**Equinox:**
R.A.= $2^{h}44^{m}19^{s}.4$ **DEC.**= $+64^{\circ}45'57''$	J2000.0

Observatory and telescope:
40-cm astrograph in Crimea

Detector:	Photoplate

Filter(s):	None

Comparison star(s):	GSC 4055.0127 $B_{pg} = 12^{m}.43$, GSC 4055.1385 $B_{pg} = 12^{m}.93$, GSC 4055.1597 $B_{pg} = 13^{m}.68$

Transformed to a standard system:	B_{pg}
Standard stars (field) used:	B-band standard sequence in NGC 1027 (Hoag et al. 1961)

Availability of the data:
Upon request

Type of variability:	DCEP

Remarks:

The variability of NSV 15563 was discovered by Yarikov (1984), who reported the photographic range $12^{m}.5$–$13^{m}.9$ but did not classify the star. We estimated by eye the brightness of the suspected variable on 158 plates from Moscow archive, JD 2433150–47836. Our data show that the star is a classical Cepheid with the following light elements:

$$\mathrm{JD_{max}} = 2439766.42 + 4^{d}.23869 \times E.$$

The color index from Tycho-2 is $B - V = +1.309 \pm 0.207$ in agreement with the δ Cep type. The variability range from our estimates ($12^{m}.6$–$13^{m}.45$) is notably smaller than that given by Yarikov. Max − min = $0^{P}.40$. The phased light curve is given in Fig. 1.

Acknowledgements:

This study was supported in part by the Russian Foundation for Basic Research and the Council of the Program for the Support of Leading Scientific Schools.

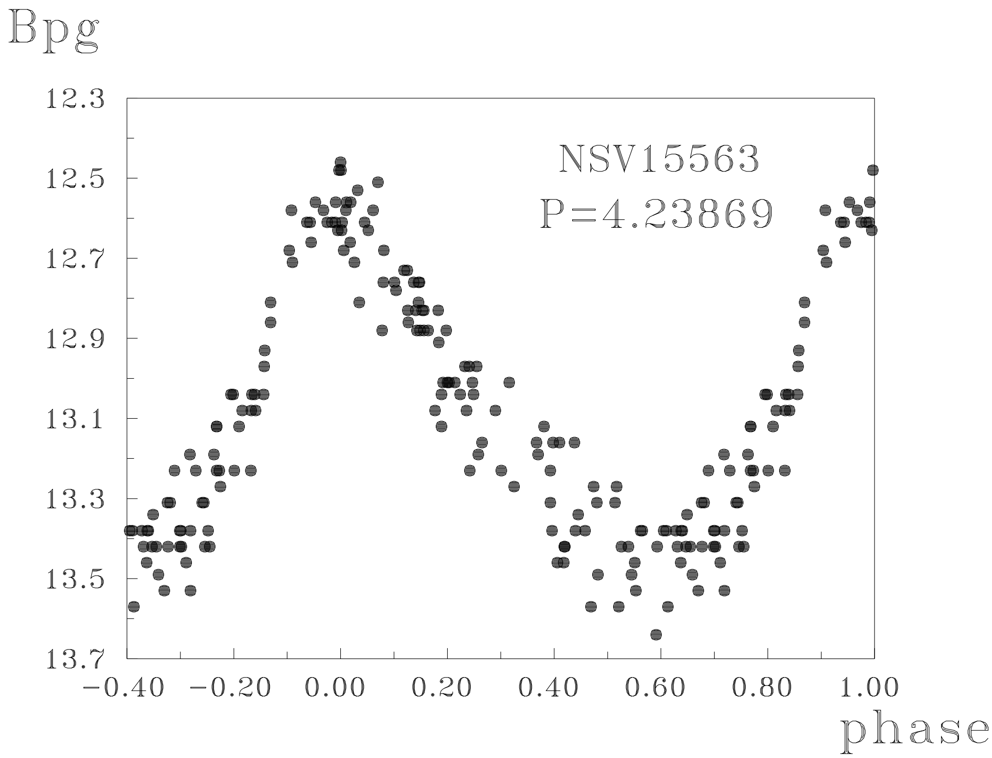

Figure 1. The phased light curve

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INFORMATION BULLETIN ON VARIABLE STARS

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HU ISSN 0374 – 0676

UW Tri: ANOTHER LIKELY WZ Sge-TYPE STAR

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UW Tri was discovered as a possible nova in 1983 by Kurochkin (1984). The discovery was communicated by Aksenov (1983). Argyle (1983) reported accurate astrometry of this possible nova, but the lack of spectroscopic observation made the nova identification inconclusive. Kurochkin (1984) reported that the object reached a maximum of 14.7 pg, and the outburst lasted at least 32 days. The light curve resembled a fast nova, but the extreme faintness and the high galactic latitude makes a normal nova unlikely. Another possibility is a WZ Sge-type dwarf nova, a small subgroup of SU UMa-type dwarf novae (see Osaki 1996 for a review), which also show a fast nova-like light curve and very long (typically $\sim$ 10 years) outburst recurrence time. The latter possibility suggested that the phenomenon can be recurrent, and a search for additional outburst was conducted by several amateur astronomers.

Meanwhile, the second historical outburst was detected by Vanmunster (1995). The detection was made on 1995 March 3.819 UT, at visual magnitude of 14.7. The outburst was confirmed by E. Broens and G. Poyner (Vanmunster 1995). James (1995) reported accurate astrometry of $02^{h}45^{m}17^{s}.30$, $+33°31'26''.5$ (J2000.0), which confirmed the absence of a counterpart of POSS-I plates. Since the presence of superhumps is the diagnostic feature of SU UMa-type dwarf novae, we started time-resolved CCD photometry.

The observations at Ouda Station, Kyoto University (Ouda) were done on eight nights between 1995 March 5 and 20, using a CCD camera (Thomson TH 7882, 576×384 pixels, on-chip 2×2 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 60–180 s depending on the brightness of the object. The frames were first corrected for standard de-biasing and flat fielding, and were then analyzed using the Java^{TM}-based PSF photometry package developed by one of the authors (TK). The observations at Keele University (Keele) on two nights 1995 March 7 and 12, using an ST-6 CCD camera and a Johnson V filter, attached to a 60-cm telescope. The exposure times were 30 s. Total numbers of useful frames were 216 (Ouda) and 421 (Keele). Both observatories used GSC 2329.320 (GSC magnitude 12.8) as the comparison star, whose constancy during the run was confirmed using GSC 2329.1501 and GSC 2329.534. By interpolating Ouda light curves and comparing Keele observations, the observations at Keele were found to be systematically fainter than Ouda observations by $0\overset{\text{m}}{.}21$. This systematic difference is probably caused by a small difference of the natural systems between these observatories, combined with the blue color of an outbursting dwarf nova. The difference will not significantly affect the following analysis. We first corrected this systematic difference. Heliocentric corrections to the observed times were made before the following analysis.

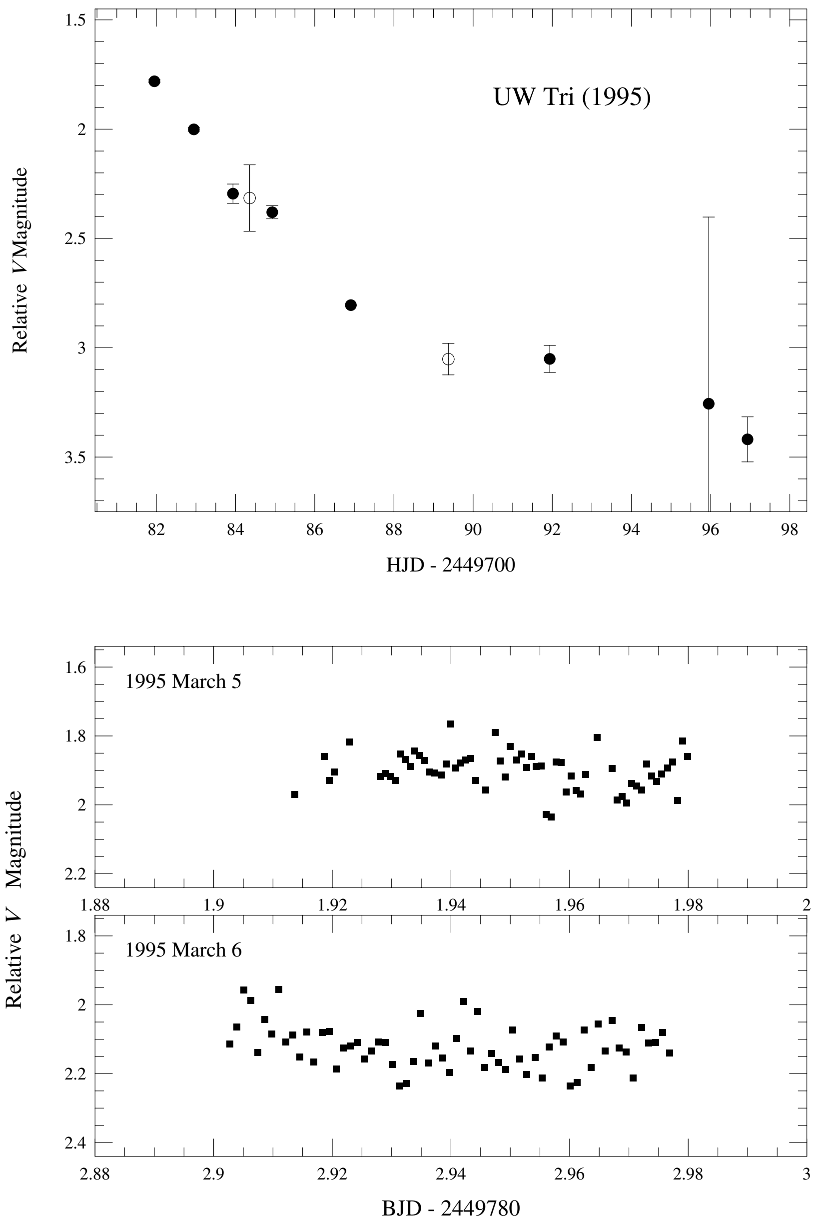

Figure 1. (Top) Overall light curve of UW Tri. Filled and open circles represent Ouda and Keele observations, respectively. (Bottom) Enlarged light curves of the first two nights.

The overall light curve is shown in Figure 1 (top). Each point represent averages and standard errors of nightly runs. The object initially rapidly faded at a rate of 0.2 mag d^{-1}, and the fading later became slower, reproducing the 1983 outburst recorded by Kurochkin (1984). The outburst lasted at least for 17 days. Owing to the short visibility in the evening, it is very difficult to make a firm conclusion on its intranight variation.

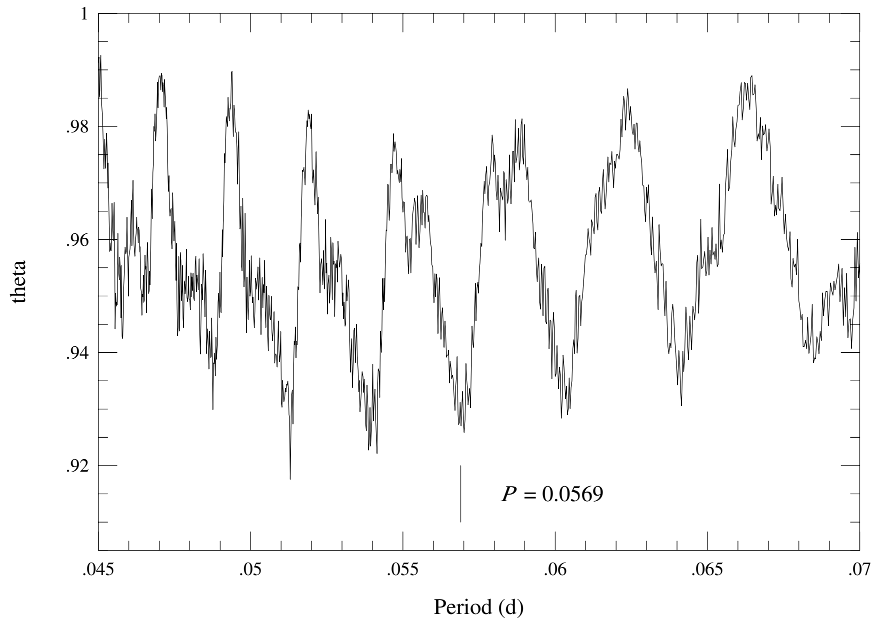

Figure 2. Periodogram of UW Tri

We applied Phase Dispersion Minimization (PDM) method (Stellingwerf 1978) to the data on the first two nights which gave the best signal-to-noise ratio. The trend of linear decline was subtracted before the analysis. The resultant theta diagram is shown in Figure 2. There are indications of the presence of short-period modulations, attributable to superhumps. Together with the long recurrence time, this finding strengthen the possibility of UW Tri being a WZ Sge-type dwarf nova. It is virtually impossible to select the unique period among strong aliases close to 0.051, 0.054 and 0.057 d. Since almost all hydrogen-rich cataclysmic variables have orbital periods longer than the period minimum of $\sim 0\overset{\mathrm{d}}{.}055$ (cf. Ritter and Kolb 1998), we adopted a period of $0\overset{\mathrm{d}}{.}0569$ as the most likely period. However, one must bear in mind that this period should be treated as the likely one among several possibilities. By adding data points made on later nights, the results remained basically unchanged.

The phase-averaged light curve by the period of $0\overset{\mathrm{d}}{.}0569$ is shown in Figure 3. The profile is characteristic to superhumps of SU UMa-type dwarf novae, but the amplitude of $0\overset{\mathrm{m}}{.}07$ is smaller than those (0.1–0.3 mag) in usual SU UMa-type dwarf novae. Given that observations were made during the rapidly fading, early epoch of a superoutburst, this modulation may be better interpreted as low-amplitude "early superhumps", characteristic to WZ Sge-type dwarf novae (Kato et al. 1996; Matsumoto et al. 1998; Kato et al. 1998). Phase-averaging of the late-phase observations had a severe difficulty with their low signal-to-noise ratio and short individual runs. By assuming the 0.0569-d period, the Keele data give $\sim 0\overset{\mathrm{m}}{.}1$ amplitudes both on March 7 and 12, suggesting that the variation may have evolved as in other WZ Sge-type stars, but the result should be treated with caution because the detection was marginal. The quiescence counterpart of UW Tri was discovered by Robertson et al. (2000) at a magnitude of $B = 22.6$–22.9, and astrometry end figures of $17\overset{\mathrm{s}}{.}29$, $26\overset{\prime\prime}{.}31$, which are in excellent agreement with James's astrometry in outburst (1995). This makes the outburst amplitude of $\sim 8\overset{\mathrm{m}}{.}0$, which is very similar to that ($\sim 8\overset{\mathrm{m}}{.}5$) of WZ Sge. All the available observations support that UW Tri is similar to WZ Sge, in large outburst amplitude, long recurrence time, and short superhump period.

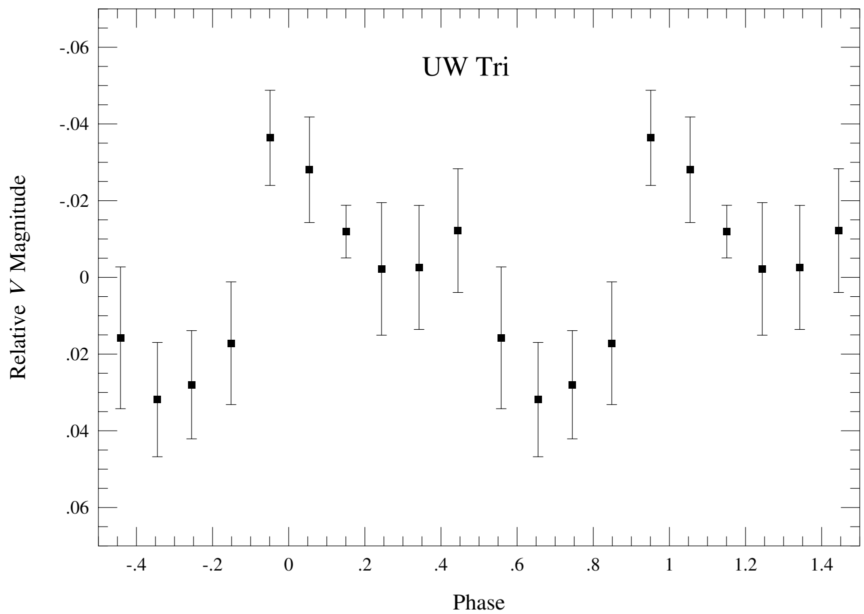

Figure 3. Phase-averaged light curve of UW Tri

Confirmation of these properties, as well as spectroscopic confirmation of its classification, is strongly encouraged in future outbursts.

The authors are grateful to VSNET members, for providing vital observations and information, especially to Tonny Vanmunster for promptly notifying the outburst.

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RX Cha: NEW LONG-PERIOD SU UMa-TYPE DWARF NOVA

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RX Cha is a little studied, faint dwarf nova. Vogt and Bateson (1982) provided a likely identification with a faint blue star on SRC plates. Bruch et al. (1992) provided astrometry of the likely quiescent counterpart. Two attempts have been made to spectroscopically identify the object in quiescence (Zwitter and Munari 1996; Munari and Zwitter 1998), but no spectroscopic information was obtained due to the faintness of the object. Zwitter and Munari (1996) gave an upper limit of $V = 20.5$ for the quiescent counterpart. The large outburst amplitude (> 6 mag) made RX Cha as a good candidate for an SU UMa-type dwarf nova. The object has been regularly monitored by visual observers, and several outbursts have been recorded.

Visual observations were done by using 32-cm (R.S.), 40-cm (A.P.) and 32-cm (P.N.) reflectors. All observations were done using photoelectrically calibrated V-magnitude comparison stars. The typical error of visual estimates was less than $0\overset{\text{m}}{.}2$ mag, which does not affect the following discussion. During the 1998 September outburst, time-resolved CCD photometry and astrometry were performed by one of the authors (G.G.), with an unfiltered AP-7 CCD attached to a 45-cm reflector. The exposure time was 60 s. A total of 216 CCD frames were taken between BJD 2451073.077 and 2451073.232. Table 1 lists the observed outbursts since 1998 January.

Figure 1 shows the CCD light curve on 1998 September 16. The magnitudes are given relative to GSC 9405.598 (Tycho-2 magnitude $V = 11.63 \pm 0.13$, $B - V = +1.15 \pm 0.31$), whose constancy during the run was confirmed using the check star GSC 9405.1400 (Tycho-2 magnitude $V = 12.11 \pm 0.18$). The light curve shows two superhumps with an amplitude of 0.15–0.20 mag. The period analysis was done using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978). The resultant theta diagram is shown in Figure 2. The best superhump period is determined as 0.0839 ± 0.0020 d. However, the apparently changing amplitude of superhumps may have slightly affected the result of the analysis.

The CCD observation during the 1998 September outburst has confirmed that RX Cha is an SU UMa-type dwarf nova. The resultant superhump period of $0\overset{\text{d}}{.}084$ makes RX Cha an SU UMa-type dwarf nova with a long orbital period (P_{orb}). Astrometry using

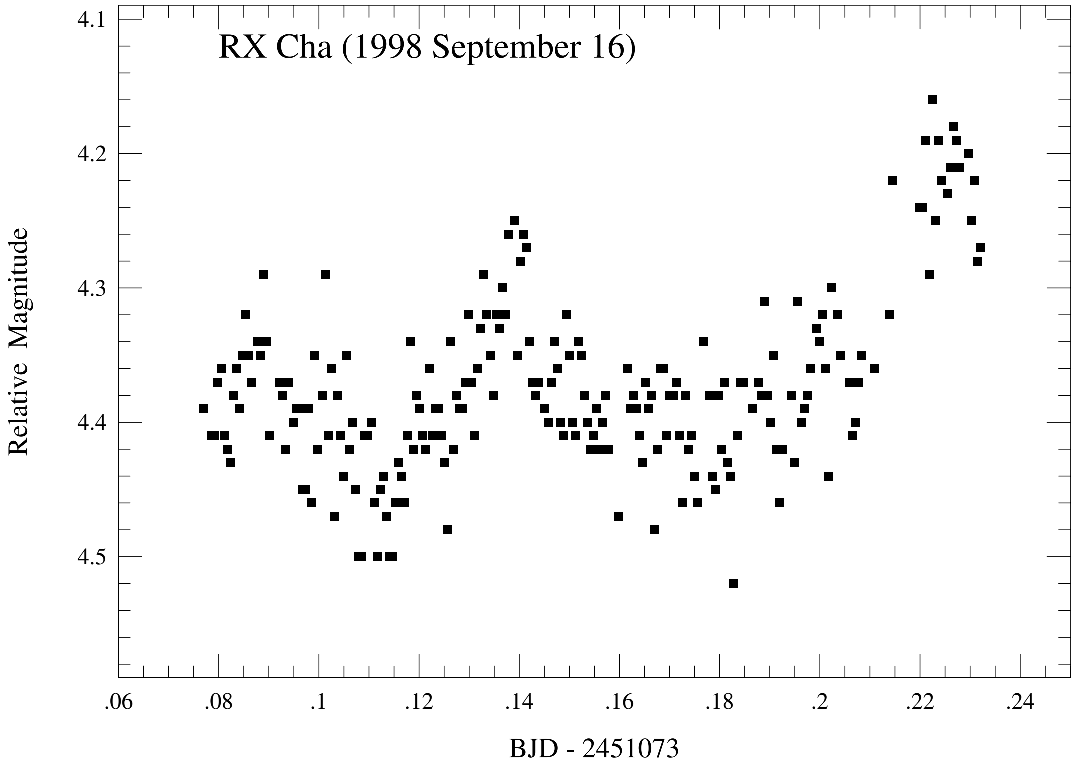

Figure 1. Light curve of RX Cha on 1998 September 16

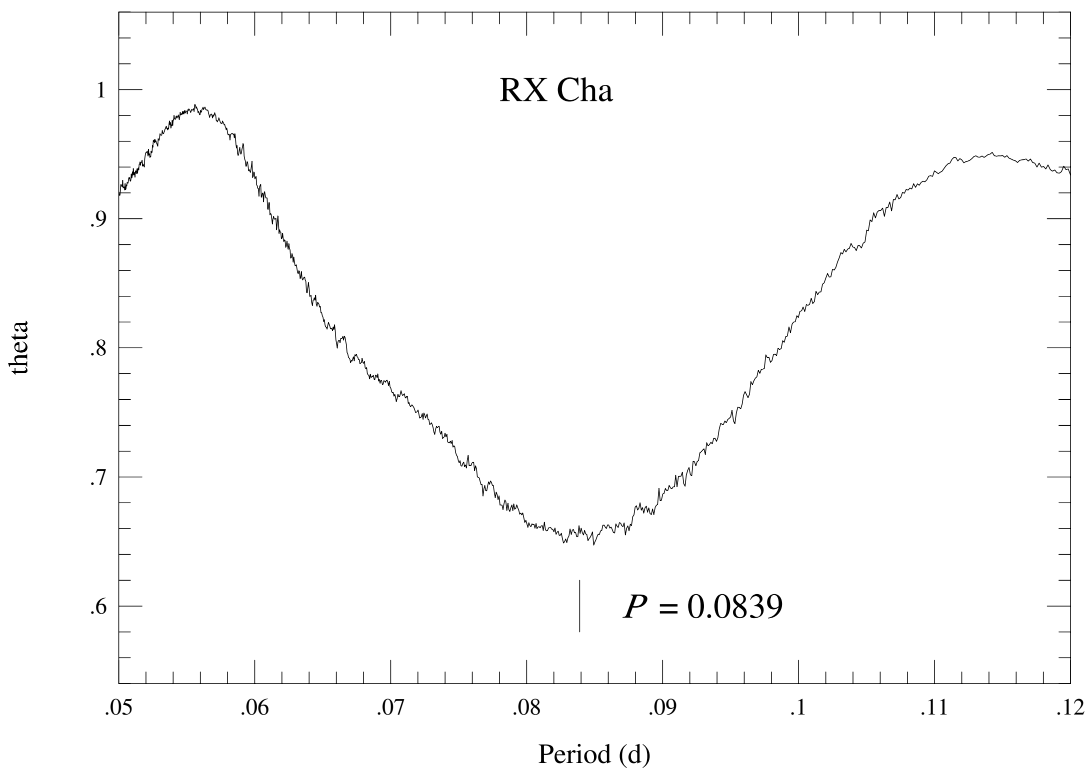

Figure 2. Periodogram of RX Cha

Table 1: Outbursts of RX Cha

JD start	peak magnitude	duration (d)
2450831	14.5	—
2451066	14.4	> 8
2451544	14.4	> 8
2451982	14.3	> 9

80 GSC stars has yield the following accurate position (mean residual $0''.4$): $10^{\rm h}36^{\rm m}26^{\rm s}.33$, $-80^\circ 02' 48''.2$ (J2000.0). This confirms the identification by Vogt and Bateson (1982), and the inferred large outburst amplitude of > 6 mag.

Some of the long orbital period SU UMa-type dwarf novae, such as YZ Cnc and SS UMi, tend to have a high outburst frequency. The low number of detected outbursts (Table 1) clearly suggests that outbursts are relatively rare in this system. All detected outbursts, except the first one, have long durations and are identified as superoutbursts. The first one was not well covered by observations, but the brightness may also suggest a superoutburst. The supercycle is thus $\sim$ 460 d, if the first outburst is a normal one, or its half, $\sim$ 230 d, if the first outburst is a superoutburst. The lack of detections of definite normal outbursts between well-observed superoutbursts may have been a result of the faintness of the object, but is more likely to directly reflect the low number of normal outbursts. Such a low number ratio of (normal outbursts)/(superoutbursts) is a common property in SU UMa-type dwarf novae with low outburst frequencies. However, such systems are known to be rare among long $P_{\rm orb}$ systems. Only a few systems are known to show similar properties: EF Peg (Matsumoto et al., in preparation), V725 Aql (Uemura et al. 2001) and DV UMa (e.g. Nogami et al. 2001). Since these systems play an important role in understanding the evolution of dwarf novae, and the origin of mass-transfer, further detailed observations of RX Cha are highly encouraged.

This work was done as a part of VSNET Collaboration (http://www.kusastro.kyoto-u.ac.jp/vsnet/).

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OUTBURST CYCLE OF V363 Lyr

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V363 Lyr (= S 9653) is a dwarf nova discovered by Hoffmeister (1967). Although the report by Hoffmeister (1967) suggested relatively frequent outbursts, only a few studies have been made since the discovery. Galkina and Shugarov (1985) studied the variable photographically, and generally confirmed the high outburst frequency suggested by Hoffmeister (1967). However, the lack of dense coverage and non-detectability at minimum made exact characterization of its outburst properties difficult. We therefore made systematic CCD runs to clarify its outburst pattern.

The observations were done on 57 nights between 1995 March 19 and 1996 September 5, using a CCD camera (Thomson TH 7882, 576 × 384 pixels, on-chip 2 × 2 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (focal length = 4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 60–180 s, depending on the brightness of the object. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based PSF photometry package developed by one of the authors (TK). The magnitudes were determined relative to GSC 3128.123 ($V = 14.26$, VSNET chart), whose constancy during the run was confirmed using GSC 3128.751. Barycentric corrections were applied to the observed times before the following analysis. A total of 604 useful frames were obtained. Since most of observations are nightly snapshots, the log of observations is omitted.

Figure 1 shows the overall light curve of V363 Lyr. The high frequency of outbursts and the high outburst duty cycle is already apparent. The observed brightest maximum and faintest minimum was $V = 15.83$ and $V = 19.5 \pm 0.2$, respectively. The maximum is in good agreement with the GCVS value ($15^{m}_{.}7$), but the minimum can become slightly fainter than was previously thought ($18^{m}_{.}6$).

Figure 2 shows a typical, and the best observed, outburst of V363 Lyr, which occurred in 1995 July–August. The almost symmetrical rise and fade are rather unusual for a dwarf nova. Table 1 lists the observed date of maxima.

The shortest interval between outbursts was 22 d, which is in good agreement with the interval observed in Hoffmeister (1967) and Galkina and Shugarov (1985). Although there is an ambiguity of cycle counts between JD 2449972 and 2450292, all the observed

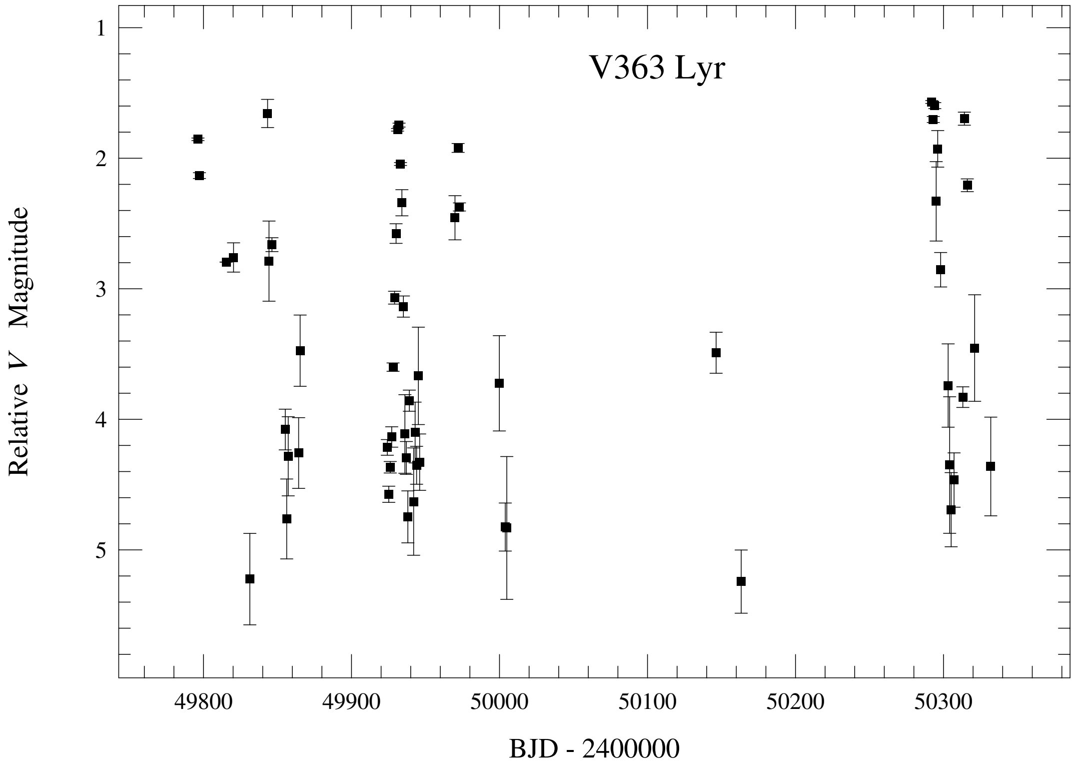

Figure 1. Overall light curve of V363 Lyr

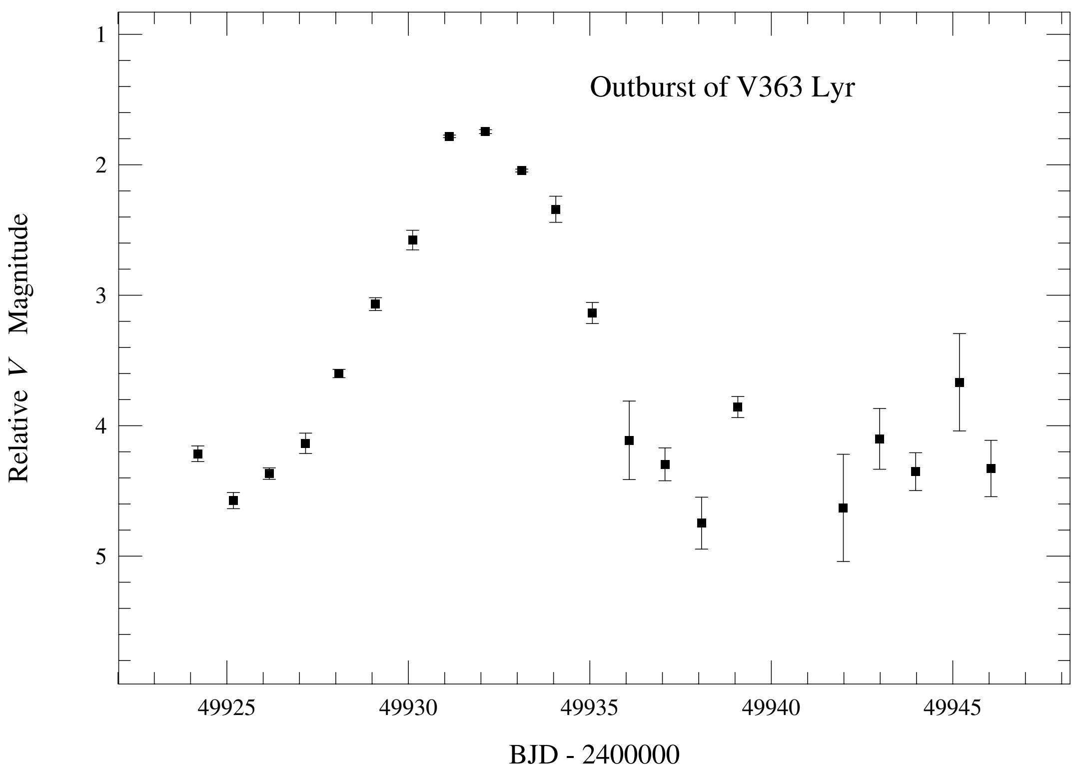

Figure 2. Typical outburst V363 Lyr

Table 1: Outbursts of V363 Lyr

JD (maximum)	magnitude
2449796	16.12
2449843	15.92
2449932	16.01
2449972	16.18
2450292	15.83
2450314	15.96

maxima are well represented by $\mathrm{JD}_{\mathrm{max}} = 2449799.7 + 21.446 \times E$ with $|O - C| < 4$ d. A light curve folded by this period is shown in Figure 3. This figure shows that the outburst pattern is relatively stable for a long time. The existence of a number of scattered points deviating from the general trend shows intrinsic variation from the semi-regular outburst pattern.

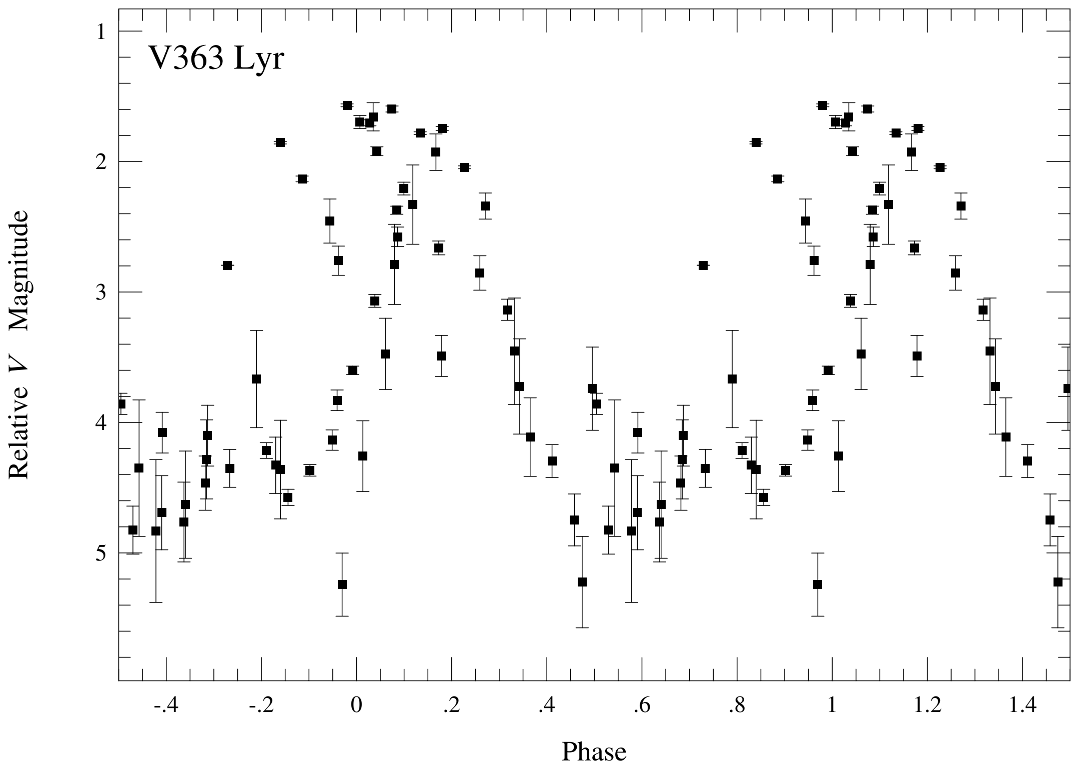

Figure 3. Light curve of V363 Lyr folded by $P = 21\overset{\mathrm{d}}{.}446$

Such a stable light curve is rather unusual for a dwarf nova. However, spectroscopic observation by Liu et al. (1999) confirmed the dwarf nova-type nature of the object. The object may be a system with high mass-transfer rate, showing regular outbursts and a slow rise to outburst. Short-term variability was searched for on 1995 March 20, August 1–3 and 1996 July 27 (around maximum), and 1995 July 25–28 (near minimum), but the search did not yield a firm periodicity. A sample of time-series observations (1996 July 27) is shown in Figure 4, which did not reveal large-amplitude oscillations.

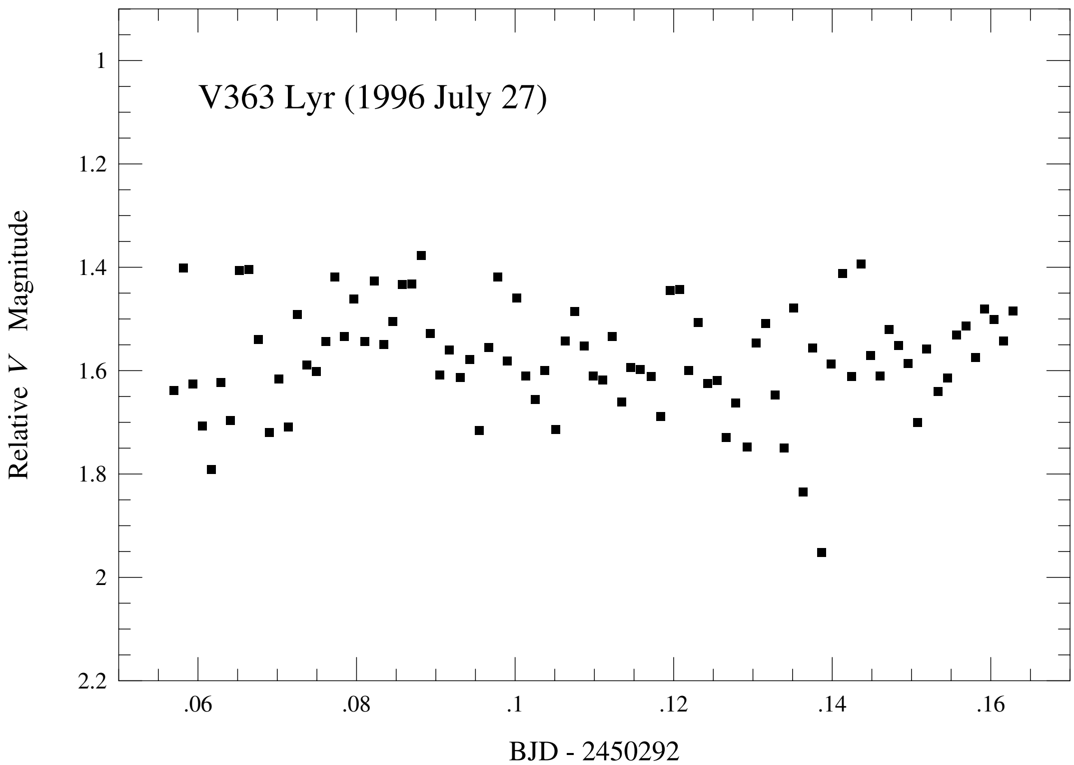

Figure 4. Light curve of V363 Lyr on 1996 July 27

The authors are grateful to Mr. Ishida for helping the observation.

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DETECTION OF SUPERCYCLE IN BF Ara: NORMAL SU UMa-TYPE DWARF NOVA WITH THE SHORTEST SUPERCYCLE

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ER UMa stars are a small subgroup of SU UMa-type dwarf novae, which have extremely short supercycles (the interval between successive superoutbursts) of 19–50 d (for a review, see Kato et al. 1999). The shortest known supercycles in "usual" SU UMa-type dwarf novae had been 90–130 d (e.g. Table 1 in Nogami et al. 1997), until the discovery a short supercycle of $84\overset{\mathrm{d}}{.}7$ in a normal SU UMa-type dwarf nova, SS UMi (Kato et al. 2000). Although several SU UMa-type dwarf novae have been found to occasionally exhibit short intervals between successive superoutbursts, only few systems are known to have intermediate outburst statistics between ER UMa stars and usual SU UMa-type dwarf novae. The importance of these intermediate objects in understanding the nature of ER UMa-type objects, and eventually the origin of mass-transfer in short-period cataclysmic variables, was described in Kato et al. (2000).

BF Ara is a dwarf nova having a range of variability 13.6–(16.0 p according to the 4th edition of the General Catalogue of Variable Stars. The star received attention by the discovery of possible superhumps with an amplitude of $0\overset{\mathrm{m}}{.}25$ by Bruch (1983). However, the star has been largely neglected by researchers. Upon noting the possible presence of a definite periodicity of occurrence of long, bright outbursts, we have selected the star as monitoring targets of VSNET Collaboration (http://www.kusastro.kyoto-u.ac.jp/vsnet/).

Visual observations were done with 32-cm (R.S.), 40-cm (A.P.), 32-cm (P.N.) and 32-cm (B.M.) reflectors. All observations were done using photoelectrically calibrated V-magnitude comparison stars. The typical error of visual estimates was less than $0\overset{\mathrm{m}}{.}2$, which does not affect the following discussion. The total number of observations between 1997 June 24 and 2001 May 3 was 372.

The overall light curve is presented in Figure 1. Each filled square represents single estimates and '$\vee$' sign represents upper limits. The quasi-periodic occurrence of long, bright outbursts and faint states associated with brief brightenings is clearly demonstrated. The behavior is very reminiscent of that of SS UMi (Kato et al. 2000). Table 1 lists the epochs of long, bright outbursts. Together with the finding by Bruch (1983), made at $V = 14.2$,

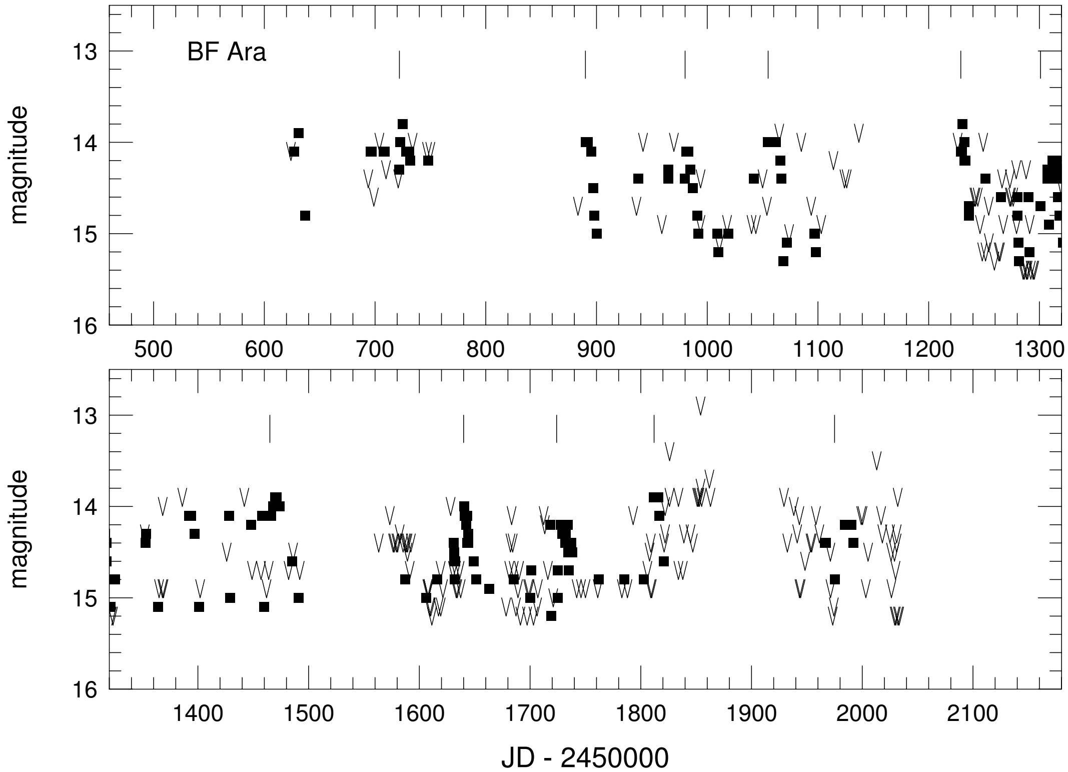

Figure 1. Light curve of BF Ara. Ticks represent epochs of superoutbursts listed in Table 1

Table 1: Superoutbursts of BF Ara

JD start	peak magnitude	duration (d)
2450722	13.8	> 10
2450890	14.0	> 11
2450980	14.1	13
2451055	14.0	17
2451229	13.8	> 7
2451301	14.3	17
2451465	13.9	19
2451640	14.0	> 11
2451724	14.2	> 14
2451812	13.9	> 9
2451975	14.2	17:

which is comparable to observed magnitudes of these outbursts, these outbursts are most likely considered as superoutbursts of an SU UMa-type dwarf nova.

Noting that the intervals of these outbursts are close to 83 d or its multiples, the supercycle was determined as $83^{\mathrm{d}}.4$, by assuming the presence of missed superoutbursts during the unobservable seasons. All observations are well expressed by this representative supercycle; Figure 2 presents a folded light curve by this period. Partly because of faint outbursts being close to the detection limit, and possibly because of slight cycle-to-cycle variation, the cycle length of normal outbursts (between superoutbursts) is slightly harder to detect than in SS UMi (Kato et al. 2000).

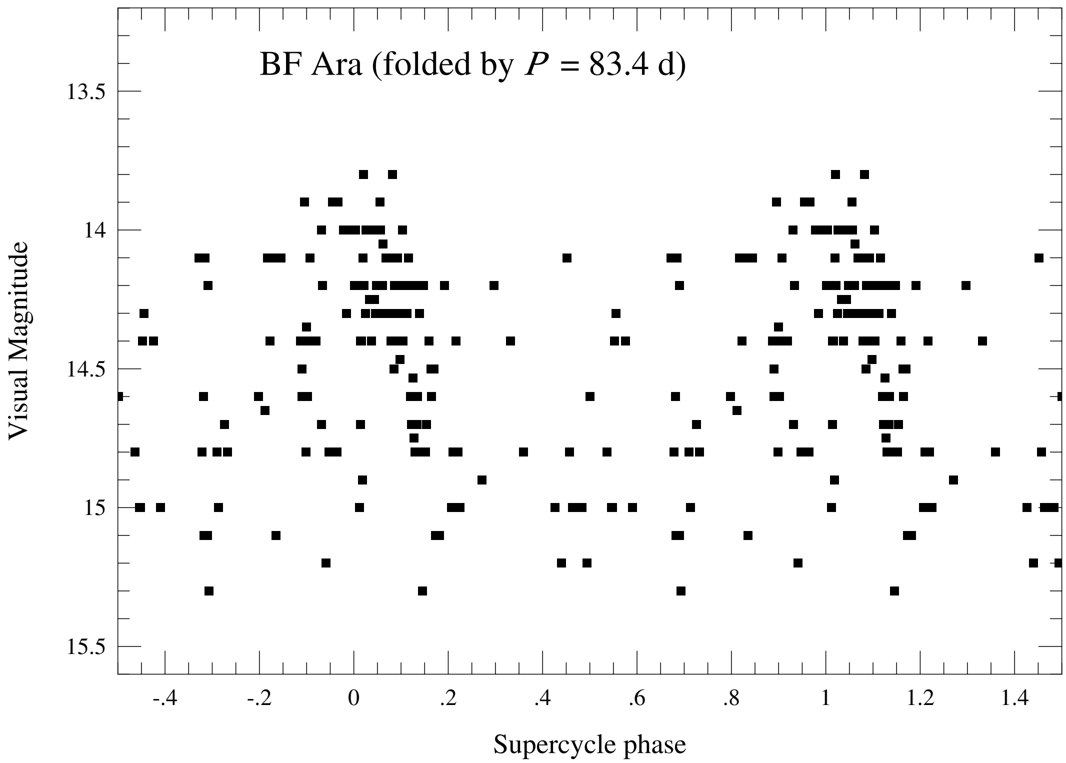

Figure 2. The 83.4-d supercycle of BF Ara. Upper limits are omitted for simplicity

The present observation suggests that BF Ara is a twin of SS UMi in its outburst pattern. The suggested superhump period slightly longer than $\sim$ 2 hr (Bruch 1983) is, however, significantly longer than that of SS UMi (Chen et al. 1991; Kato et al. 1998), but is close to that of YZ Cnc, as originally suggested by Bruch (1983). Since YZ Cnc is another active SU UMa-type dwarf nova, although its supercycle exceeds 100 d, the similarity is not surprising. Detailed observations to determine the superhump characteristics of BF Ara are strongly encouraged.

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THE SECOND SUPERCYCLE OF THE HELIUM ER UMa STAR, CR Boo

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CR Boo is the prototype of the helium dwarf novae (for a review of helium cataclysmic variables, or AM CVn stars, see Warner 1995), which show very frequent outbursts and superoutbursts. The characters of outbursts in CR Boo is regarded as equivalent to ER UMa stars (for a review, see Kato et al. 1999) in hydrogen-rich cataclysmic variables. Kato et al. (2000) showed that the overall light behavior of CR Boo is well represented by a supercycle (the recurrence time of superoutbursts) of $46^{\rm d}.3$. The shortness of the supercycle qualifies CR Boo as a helium counterpart to hydrogen-rich ER UMa stars (Kato et al. 2000). The observed properties are in good agreement with the theoretical light curve (Tsugawa and Osaki 1997).

During the extensive observing campaign by the VSNET Collaboration (http://www.kusastro.kyoto-u.ac.jp/vsnet/), we noticed a significant change in the outburst pattern in CR Boo. Figure 1 shows the light curves drawn from visual observations. The observations used comparison stars calibrated in the V-band, and the typical error of a single estimate is $\sim 0^{\rm m}.2$, which will not affect the following discussion. There is already evident cyclic variations with a period remarkably shorter than previously reported.

Figure 2 shows the result of period analysis, using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978). The best period is $14^{\rm d}.7$, which is remarkably shorter than the $46^{\rm d}.3$ period. Figure 3 shows the folded light curve by this period. The light curve clearly shows the slowly declining plateau portion between phase 0.0 and 0.6, and a

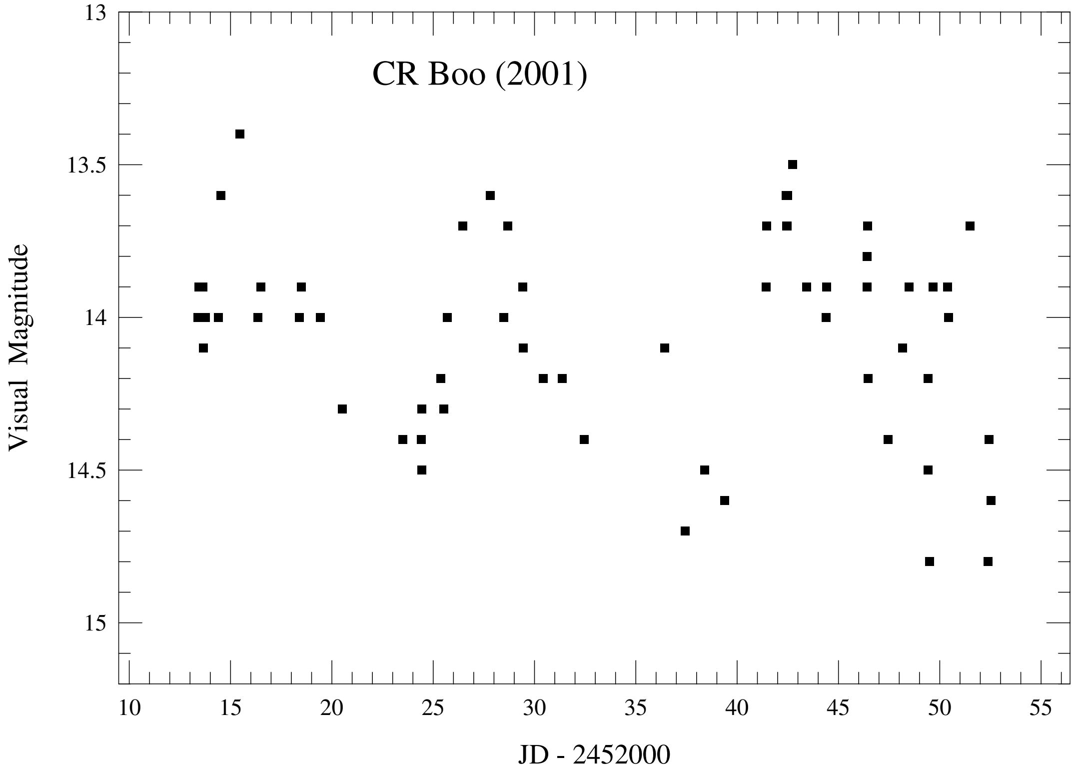

Figure 1. Light curve of CR Boo

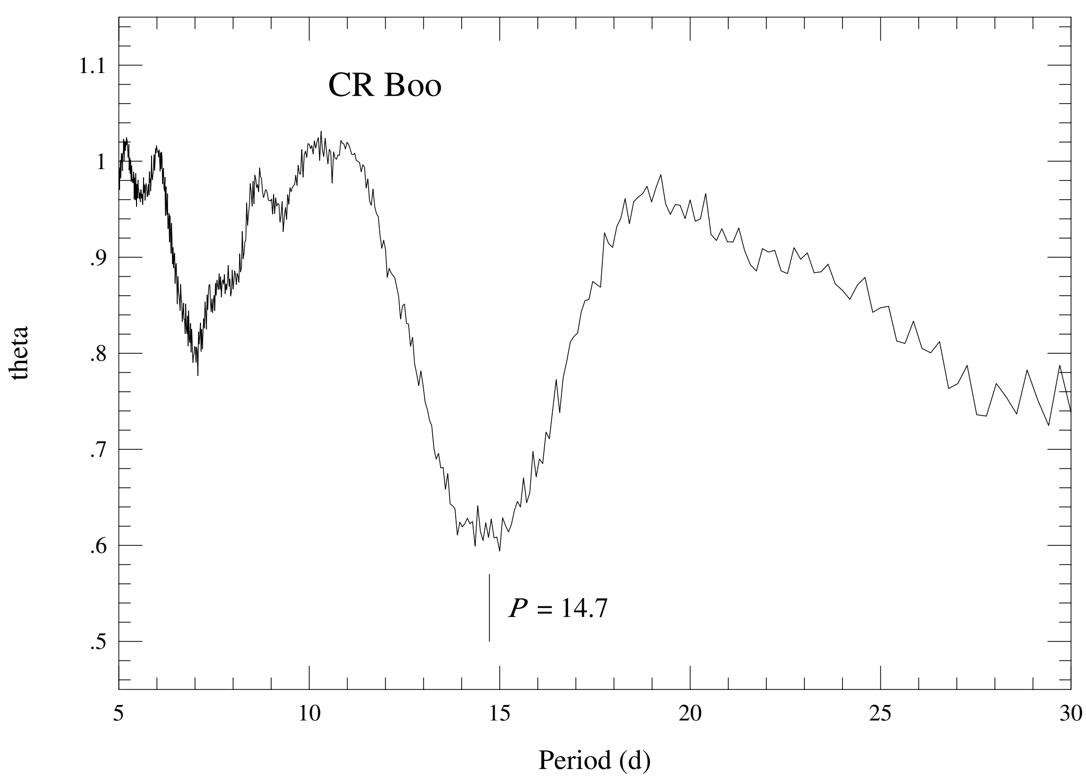

Figure 2. Periodogram of CR Boo

faint state between 0.6 and 0.8. The linear decline observed in the section of the outburst between phase 0.0 and 0.6 closely resembles superoutburst plateau observed in other ER UMa stars and helium ER UMa stars. Thus we have found a second supercycle in CR Boo, with an extremely high superoutburst duty cycle of 0.6.

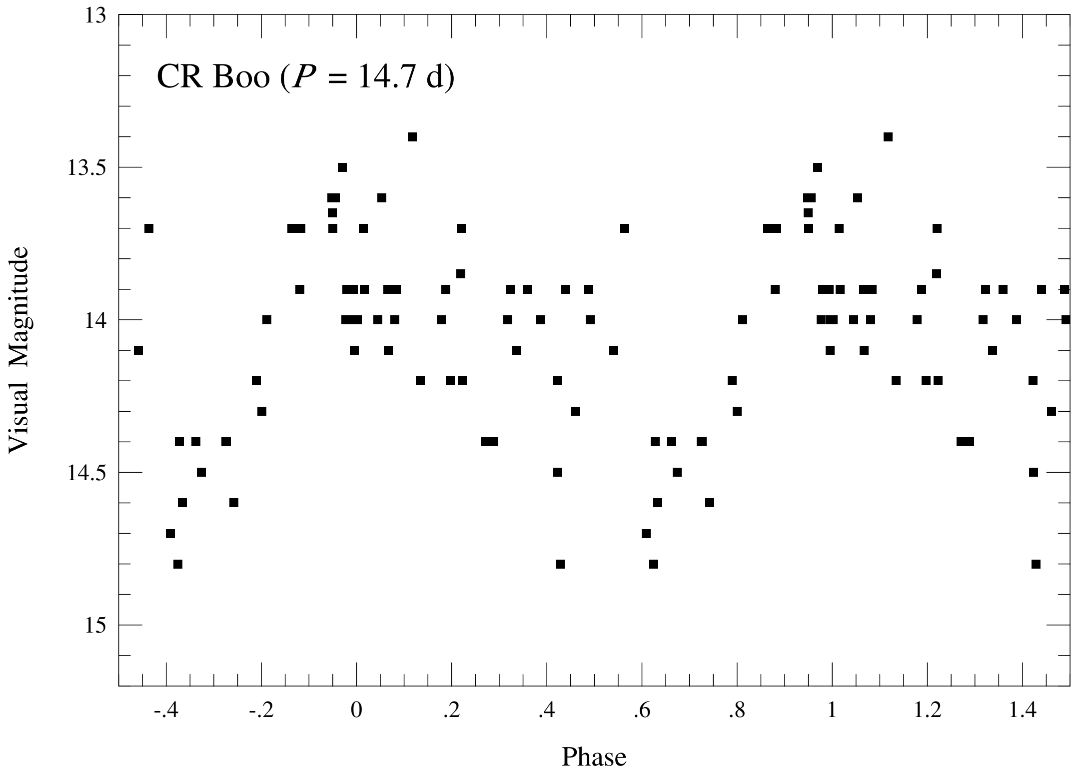

Figure 3. Folded light curve of CR Boo

Among hydrogen-rich ER UMa stars, RZ LMi (Robertson et al. 1995; Nogami et al. 1995) and DI UMa (Kato et al. 1996) have extremely short supercycles of 19–25 d. They are sometimes called RZ LMi stars, because of their peculiar characters. In hydrogen-rich systems, such a short supercycle cannot be explained by simply increasing the mass-transfer rate from the secondary star. Osaki (1995) proposed that a low tidal torque by the secondary is responsible for such short supercycles. It is not yet clear whether the same argument applies in helium ER UMa stars. If the newly discovered supercycle is explained by a temporary increase of mass-transfer rate, this would provide an evidence of changing mass-transfer rates in helium ER UMa stars. Otherwise, the present detection of a new supercycle would provide the first evidence of an alternation between usual ER UMa-state and peculiar RZ LMi-state in the same system.

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PHOTOMETRY OF UZ Tau

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UZ Tau is a well-known classical T Tau star which is considered to be surrounded by a circumstellar disk (e.g. Ghez et al. 1994). The object is also a famous multiple system, composed of a visual binary system UZ Tau E and UZ Tau W, which are known to be spectroscopic and speckle binaries, respectively (Jensen et al. 1996; Mathieu et al. 1996). The object is also considered as a member of EXORs, or sub-FUORs (Herbig 1989), which show occasional outbursts lasting $\sim$ 100 d. More recently, one of EXORs, V1143 Ori, showed a short-term rise and fall with a time-scale of an order of magnitude shorter than those of the historically known outbursts of EXORs (Baba et al. 2001). We selected UZ Tau as one of our long-term monitoring project of EXORs.

The observations were done on 33 nights between 1996 November 14 and 1997 December 25, using a CCD camera (Thomson TH 7882, 576×384 pixels, on-chip 2×2 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (focal length = 4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 20–30 s, depending on the transparency. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based aperture photometry package developed by one of the authors (TK). UZ Tau is known to be a very close double (the fainter component has a B magnitude of 15.16, and a spectral type of M4Ve), but the present photometry was done for the combined light, since the separation of the components was impossible. The magnitudes were determined relative to GSC 1833.587 (V = 13.74), whose constancy during the run was confirmed using GSC 1833.381 (V = 13.80). The magnitudes of comparison and check stars were determined using HIP 21134 (V = 9.74, $B - V$ = +0.57). Table 1 lists the log of observations, together with nightly averaged magnitudes.

The light curve is shown in Figure 1. In average, the object was $\sim 0\overset{m}{.}5$ brighter in 1996 than in 1997, which suggests that UZ Tau experienced an active phase in 1996. The most remarkable phenomenon was a flare peaking on JD 2450432. Figure 2 shows the enlarged light curve of the flare. The rise of $\sim 0\overset{m}{.}6$ took less than two days, and the overall time scale of the event was $\sim$ 10 d. Although the amplitude of the flare ($\sim 1\overset{m}{.}0$) is smaller than those of other small outbursts in EXORs, the time scale of the event is comparable to the "rapid" flare observed in V1143 Ori (Baba et al. 2001). The presence of such rapid

Table 1: Nightly averaged magnitudes of UZ Tau

mid-JD[a]	mean mag[b]	error[c]	N^d
50402.182	−1.136	0.080	3
50404.060	−1.216	0.019	3
50407.215	−0.974	0.004	5
50427.101	−1.202	0.006	5
50429.090	−1.128	0.007	5
50432.144	−1.627	0.013	5
50438.160	−1.588	0.007	3
50439.023	−1.245	0.020	3
50441.012	−1.184	0.042	3
50442.028	−1.111	0.039	3
50445.065	−1.066	0.010	5
50448.058	−0.815	0.008	5
50448.999	−1.201	0.009	3
50449.940	−1.136	0.029	3
50451.000	−1.512	0.034	3
50452.019	−1.710	0.075	7
50452.944	−1.631	0.011	5
50455.085	−0.841	0.072	5
50457.032	−0.824	0.011	3
50461.087	−0.984	0.006	3
50462.080	−0.953	0.019	3
50464.117	−0.735	0.010	3
50468.890	−0.973	0.011	5
50507.949	−0.525	0.016	5
50509.024	−0.554	0.007	5
50512.976	−0.459	0.006	5
50515.956	−0.738	0.005	5
50518.958	−0.636	0.007	5
50672.298	−0.472	0.029	2
50675.288	−0.577	0.029	3
50676.292	−0.792	0.011	3
50677.272	−0.581	0.015	3
50808.103	−1.078	0.019	3

[a] JD − 2400000
[b] Magnitude relative to GSC 1833.587 ($V = 13.74$)
[c] Standard error of nightly average
[d] Number of frames

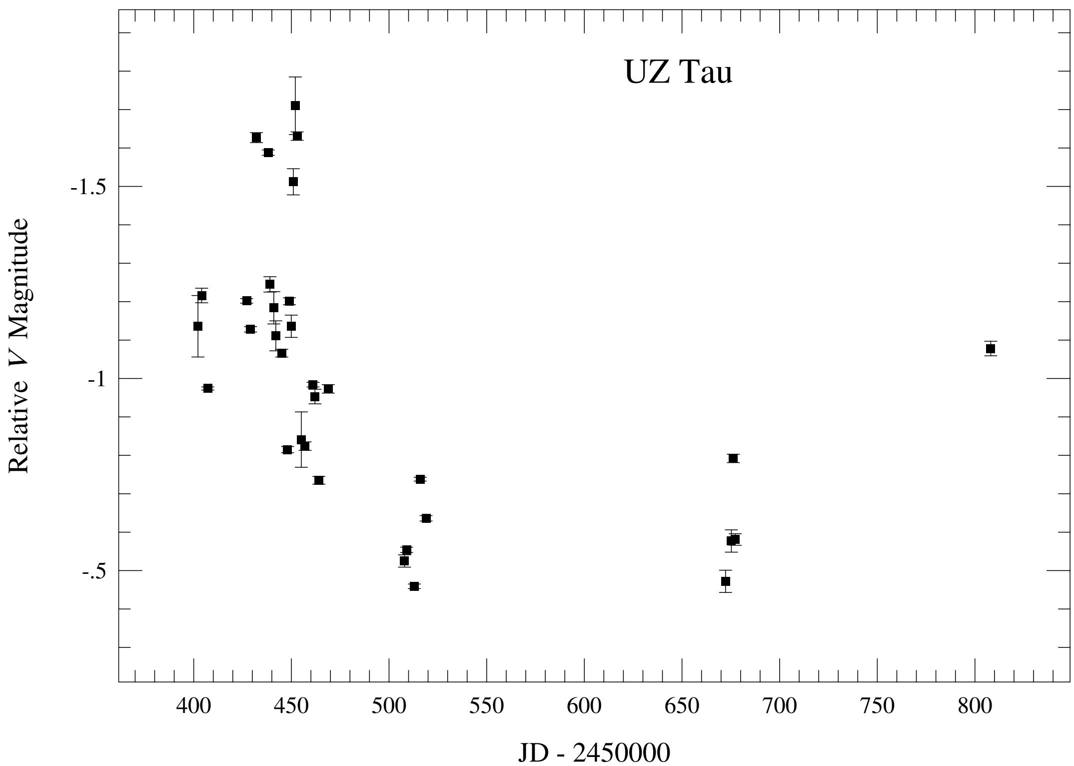

Figure 1. Overall light curve of UZ Tau

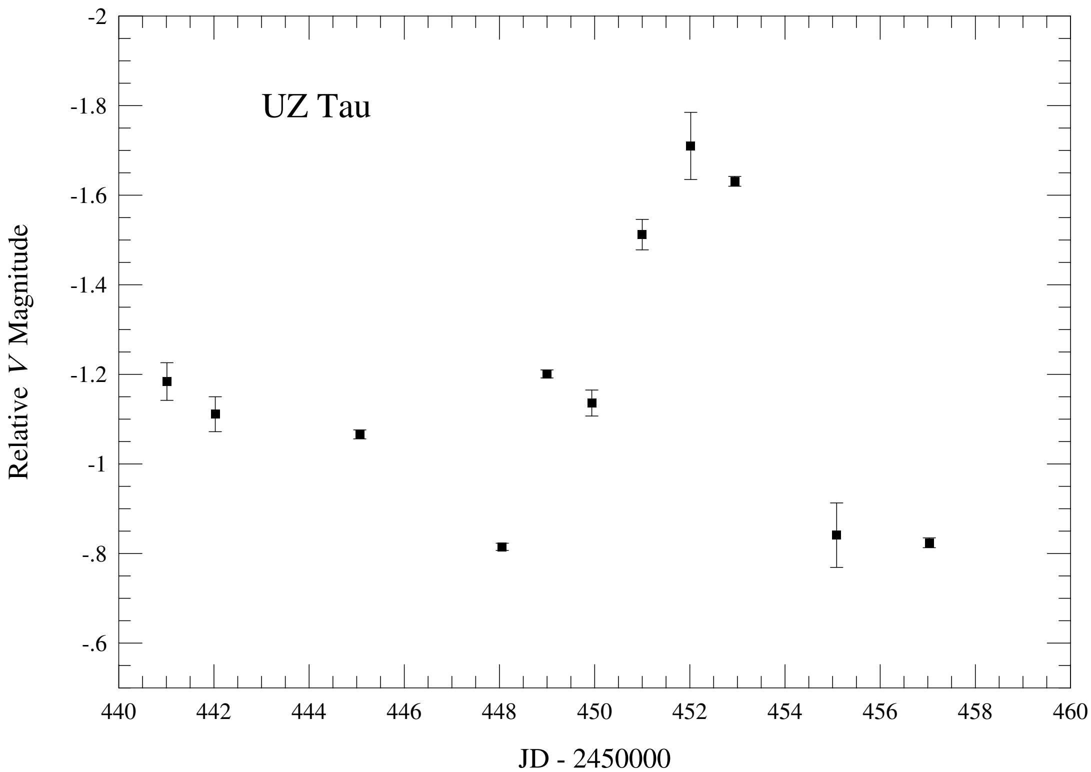

Figure 2. Flare (outburst) of UZ Tau

variation is difficult to explain by the viscous accretion in the protostellar disk. This may be another evidence of magnetically controlled accretion supposed in EXOR stars.

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OBSERVATION OF SUPERHUMPS IN IR Gem

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IR Gem is a well-known SU UMa-type dwarf nova. However, little observation of superhumps has been reported since the identification as an SU UMa-type dwarf nova (Szkody et al. 1984). We observed this star during its 1991 March superoutburst.

The observations were done on two successive nights, 1991 March 18 and 19, using a CCD camera (Thomson TH 7882, 576 × 384 pixels, on-chip 3 × 3 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (focal length = 4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the I_c band. The exposure time was 10 s. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based aperture photometry package developed by the author. The magnitudes of the object were determined relative to GSC 1905.753 (GSC magnitude 11.07), whose constancy during the run was confirmed using the check star USNO A1.0-1125.04589035. Barycentric corrections to observed times were applied before the following analysis. Table 1 lists the log of observations, together with nightly averaged magnitudes.

Figure 1 shows the resultant light curve. Superhumps are prominently seen. After removing the trend of decline, we applied Phase Dispersion Minimization (PDM) method (Stellingwerf 1978). The resultant theta diagram is shown in Figure 2. The result generally confirms the superhump period of $0\overset{d}{.}07076$ reported by Szkody et al. (1984). The best period determined from our data is 0.07094 ± 0.00006 d, which is slightly longer than that by Szkody et al. (1984). By taking the orbital period of $0\overset{d}{.}0684$ (Feinswog et al. 1988), the fractional superhump excess is 3.7%. The most remarkable difference of superhumps from those observed by Szkody et al. (1984) is the clear presence of secondary superhumps, i.e. bump-like feature on the fading branch of superhumps. The feature was markedly seen on 1991 Mar 18, but became less clear on the subsequent night. This feature was discussed by Udalski (1990) on SU UMa itself. Udalski (1990) proposed that this feature may arise from a cooler component of the disk, but the nature is not still well understood. The appearance of secondary superhumps in I_c band light curve may be consistent with Udalski's (1990) hypothesis.

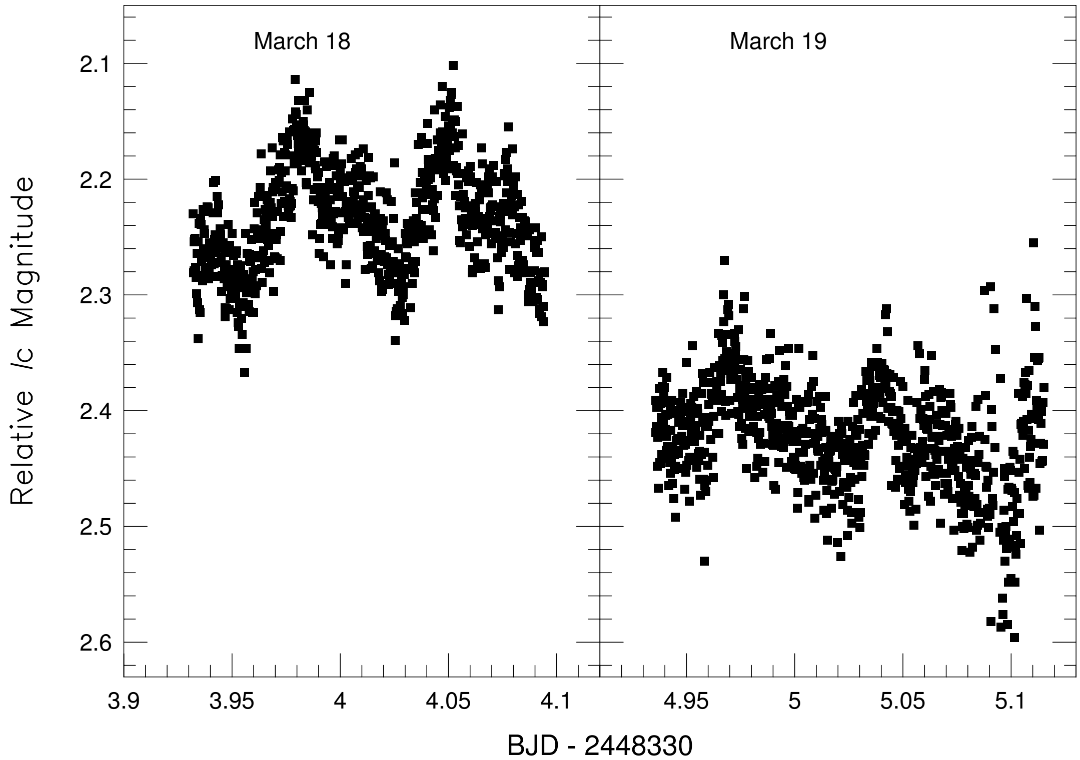

Figure 1. Light curve of the 1991 March superoutburst of IR Gem

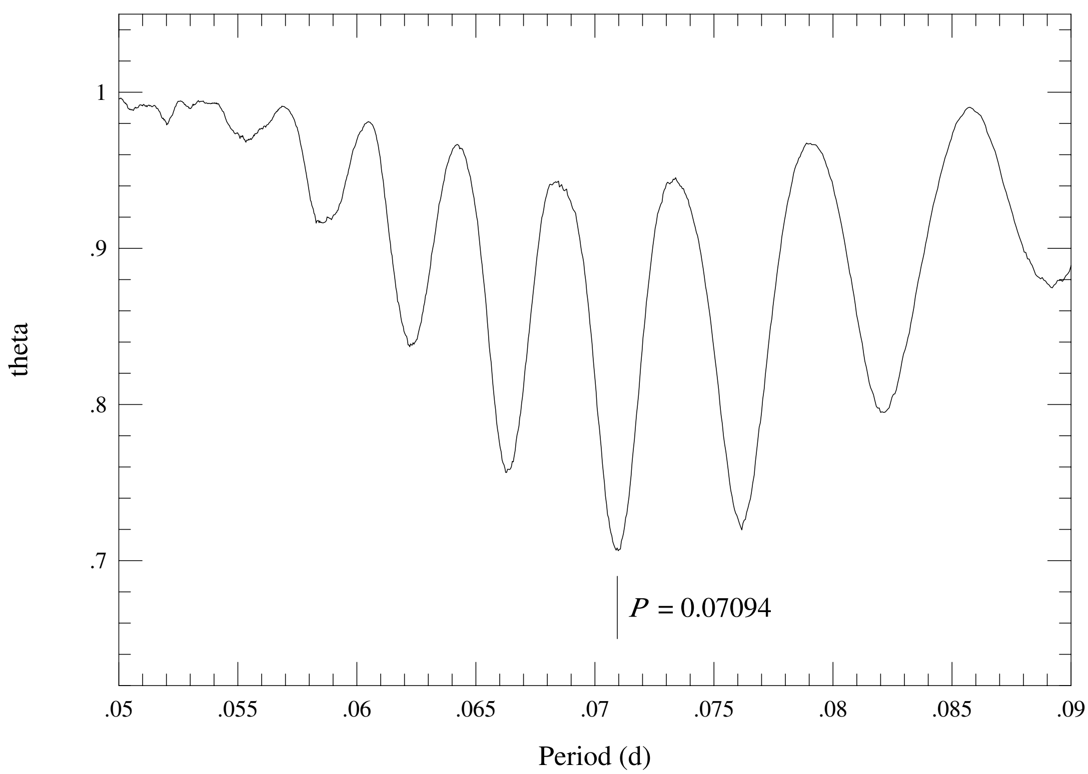

Figure 2. Periodogram of IR Gem

Table 1: Log of observations

start[a]	end[a]	mean mag[b]	error[c]	N[d]
48333.932	48334.084	2.234	0.002	760
48334.936	48335.115	2.420	0.002	816

[a] BJD − 2400000
[b] Magnitude relative to GSC 1905.753
[c] Standard error of nightly average
[d] Number of frames

References:

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OUTBURST PHOTOMETRY OF TmzV34

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TmzV34 is a variable star discovered by Takamizawa (1998). The J2000.0 coordinates are $09^{\mathrm{h}}15^{\mathrm{m}}51\overset{\mathrm{s}}{.}69$, $+09^{\circ}00'49\overset{''}{.}9$. Although Takamizawa's initial observations suggested rather irregular variations, a noticeable brightening to $13\overset{\mathrm{m}}{.}1$ was recored on films taken on 1994 November 30. The star was also likely identified with the ROSAT source 1RXS J091552.3+090056 = RX J0915.8+0900, which led to a possible classification as a cataclysmic variable. The ROSAT source was independently identified with the same star through the Hamburg/RASS Optical Identifications (Bade et al. 1998). The star was also recorded bright ($V = 12.99$) in GSC, which made the dwarf nova-type variability likely. Since then, the star has been monitored as a part of VSNET Collaboration (http://www.kusastro.kyoto-u.ac.jp/vsnet/). The first outburst since the discovery was detected by T. Watanabe (Watanabe and Kato 1999) at visual magnitude 13.6 on 1999 April 8, which made the secure identification of the variable as a dwarf nova. This outburst, however, was not fully followed because of unfavorable observing condition.

The next outburst detection was made by one of the authors (P. Schmeer), who observed the object using the Iowa Robotic Observatory (IRO) 0.5-m telescope and an AP-8 CCD, and found it slowly brightening from unfiltered CCD magnitude of 15.4 on 2000 February 3.444 UT to 14.2 on February 8.319 UT (Schmeer 2000). Upon this detection, we started time-resolved CCD photometry. The CCD observations at Kyoto University were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java$^{\mathrm{TM}}$-based aperture photometry package developed by one of the authors (TK). The CCD observations at Conder Brow Observatory were done using an SXL8 CCD attached to a 33-cm reflector. The exposure time was 45 s. The Kyoto and Conder Brow observations used different comparison stars, GSC 819.542 (GSC magnitude 13.07) and GSC 819.281 (GSC magnitude 13.41), respectively, because of the different field-of-view of the images. We therefore treat these observations separately. Barycentric corrections were applied to the observed times before the following analysis. Table 1 lists the log of observations, together with nightly averaged magnitudes. Table 2 lists the snapshot observations by P. Schmeer.

Table 1: Log of time-series observations of TmzV34

start[a]	end[a]	mean mag[b]	error[c]	N^d	Observatory
51584.228	51584.296	0.234	0.014	82	Kyoto
51585.195	51585.335	0.611	0.012	221	Kyoto
51585.388	51585.517	0.320	0.006	168	Conder Brow (CB)

[a] BJD − 2400000
[b] Magnitude relative to GSC 819.542 (Kyoto) or GSC 819.281 (CB)
[c] Standard error of nightly average
[d] Number of frames

Table 2: Snapshot observations of TmzV34

BJD − 2400000	unfiltered CCD mag
51577.949	15.4
51578.797	15.2
51579.824	15.1
51581.938	14.4
51582.824	14.2
51584.811	14.0

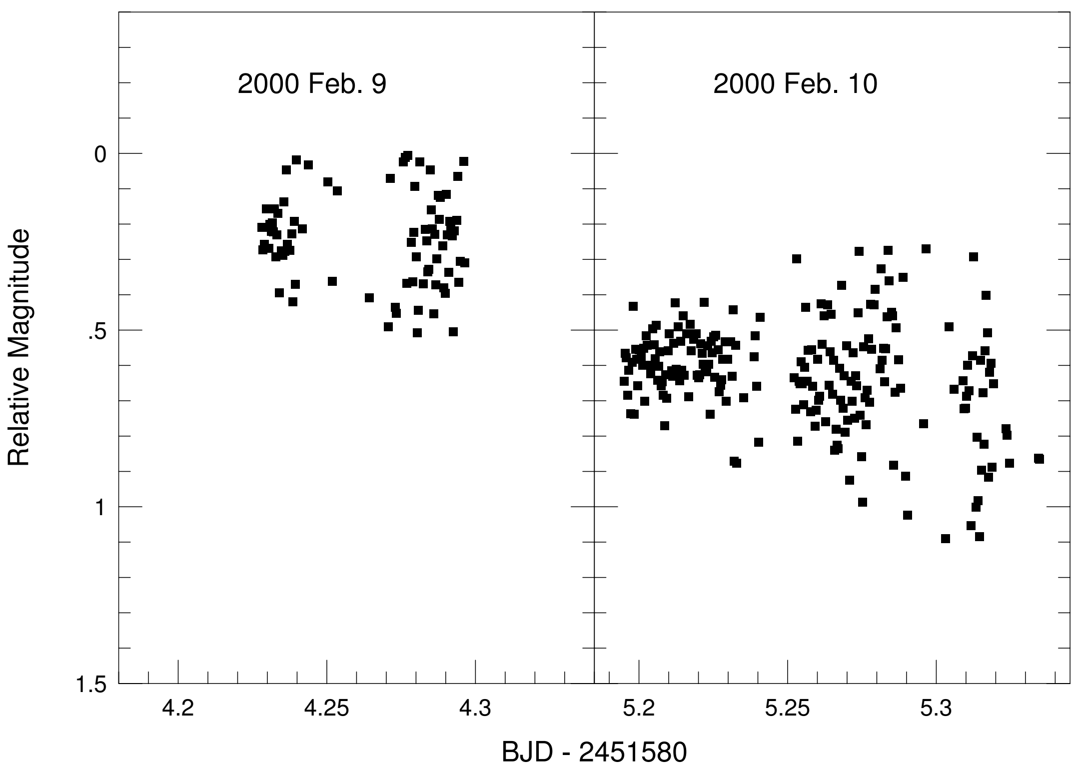

Figure 1. Light curves of Kyoto Observations. The relatively large scatter was due to passing clouds

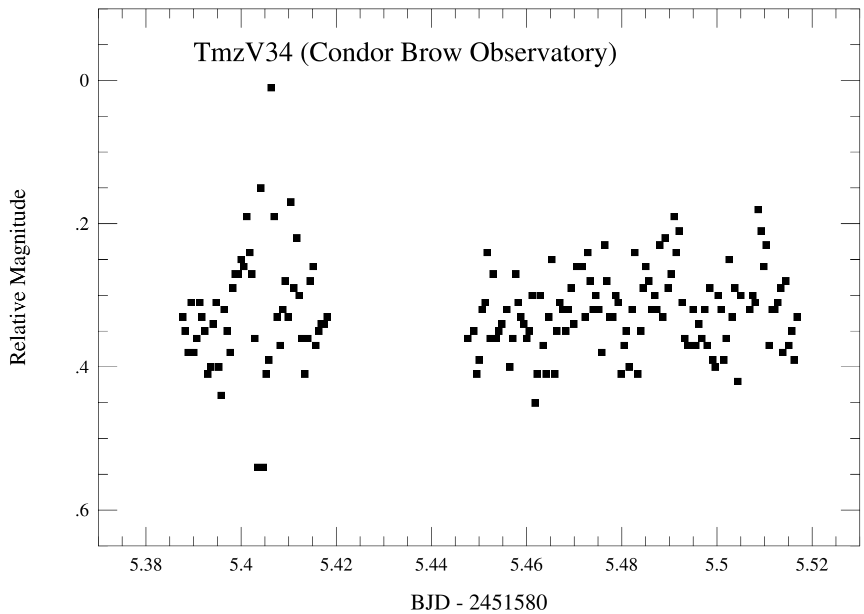

Figure 2. Light curves of Conder Brow Observations

Figures 1 and 2 show the result of Kyoto and Conder Brow Observations, respectively. The Kyoto observations show only slow fading, and the fading almost stopped in the Conder Brow Observations. No apparent superhumps were detected. The Kyoto observations having been affected by clouds, the Conder Brow observations (Figure 2) more adequately represent the absence of regular superhump-type oscillations. These observations qualifies TmzV34 as an SS Cyg-type (UGSS in GCVS) dwarf nova. The slow rising at an almost constant rate of 0.22 mag d^{-1} (as calculated from Table 2) also supports the SS Cyg-type classification. The low outburst amplitude and the slow rise make TmzV34 as a good candidate for a dwarf nova with a long orbital period.

The authors are grateful to VSNET members for providing visual observations covering years. P. Schmeer's observations were made with the Iowa Robotic Observatory, and he wishes to thank Robert Mutel and his students. Part of this work is supported by a Research Fellowship of the Japan Society for the Promotion of Science for Young Scientists (MU).

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Takamizawa, K., 1998, *VSNET observations*, No. 10504 (available from http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/obs10000/msg00504.html)

Watanabe, T., Kato, T., 1999, *VSNET alert circulation*, No. 2854 (available from http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/alert2000/msg00854.html)

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OUTBURSTS OF CG Dra

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CG Dra is a faint dwarf nova discovered by Hoffmeister (1966). He reported frequent occurrence of outbursts and a small outburst amplitude. Bruch et al. (1987) observed this object on eight nights and found one outburst. Cannon Smith et al. (1997) obtained spectra and detected the feature of a K-type secondary. Bruch et al. (1997) found spectral type of K5 $\pm$ 2 for the secondary. Bruch et al. (1997) also detected variations in the observed radial velocities of Balmer emission lines. From these variations, they suggested a possible orbital period of $0^{\mathrm{d}}.1893$ or $0^{\mathrm{d}}.2343$. However, they argued that the spectral type of K5 $\pm$ 2 corresponds to a longer orbital period of $\sim 0^{\mathrm{d}}.27$. Bruch et al. (1997) also found inconsistencies between the radial velocities of emission lines and the absorption features, which they attributed to the secondary. These inconsistencies suggest that either the canonical model is wrong, or the object is a peculiar system.

The observations were done on six nights between 1996 May 6 and July 29, using a CCD camera (Thomson TH 7882, 576 $\times$ 384 pixels, on-chip 2 $\times$ 2 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (focal length = 4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 60–120 s depending on the brightness of the object. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based PSF photometry package developed by one of the authors (TK). The magnitudes were determined relative to GSC 3920.1216 (GSC magnitude 13.12), whose constancy during the run was confirmed using the check star GSC 3920.954 (GSC magnitude 14.67). Table 1 lists the log of observations, together with nightly averaged magnitudes. The overall light curve is shown in Figure 1.

Two outbursts were observed, both on their fading stages. The high frequency of outbursts is also inferred from this observation. The outburst cycle length is shorter than 82 d. Both outbursts faded very slowly. The first outburst showed a linear decline at a rate of 0.14 mag d^{-1}. The second outburst showed a slightly varying decline rate, and its nominal average was 0.31 mag d^{-1}. Although the data points are few to accurately determine the typical decline rate of this object, the values on the both occasions are remarkably smaller than decline rates in other dwarf novae (cf. Warner 1995). This is consistent with the spectroscopic evidence that CG Dra shows a large contribution from the secondary, suggesting a long orbital period. Since DX And (Kato and Nogami 2001), having an orbital period of $0^{\mathrm{d}}.4405$, showed a rate of decline of 0.35 mag d^{-1}, Bailey's relation (cf. Szkody and Mattei 1984; Warner 1995) suggests an even longer period for

Table 1: Nightly averaged magnitudes of CG Dra

mid-JD[a]	mean mag[b]	error[c]	N^d	mid-JD	mean mag	error	N
50210.181	2.532	0.059	5	50292.042	3.064	0.087	4
50213.266	2.917	0.059	3	50293.130	3.538	0.058	5
50218.291	3.634	0.140	3	50294.125	3.699	0.111	5

[a] JD − 2400000 [b] Magnitude relative to GSC 3920.1216
[c] Standard error of nightly average [d] Number of frames

CG Dra. From the photometric point of view, we support the longer orbital period inferred from the spectroscopic classification of the secondary. The apparent periodicity in the radial velocity variation, as already argued by Bruch et al. (1997), seems to more reflect something other than the orbital motion itself.

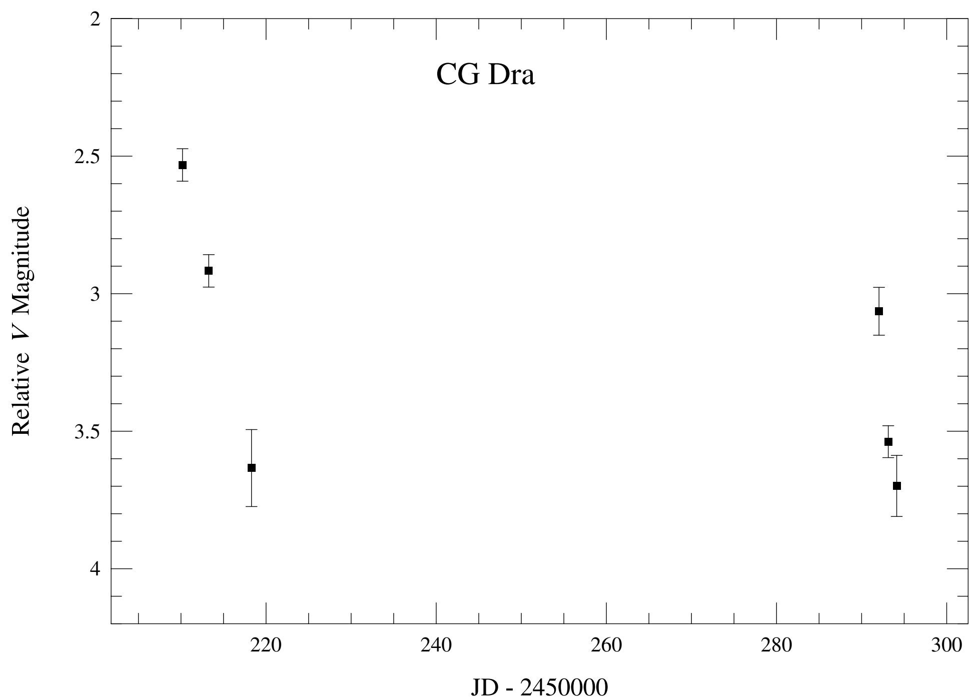

Figure 1. Overall light curve of CG Dra

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CCD LIGHT CURVES OF ROTSE1 VARIABLES, X: GSC 2016:830 Boo, GSC 2022:79 Boo, GSC 2020:736 Boo AND GSC 2020:873 Boo

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VAR 1

Name of the object:
GSC 2016:830 = ROTSE1 J144726.56+224515.0

Equatorial coordinates:	**Equinox:**
R.A.= $14^h47^m26.6^s$ **DEC.=** $+22°45'15''$	2000.0

Comparison star(s):	GSC 2016:300

Check star(s):	GSC 2016:1146

VAR 2

Name of the object:
GSC 2022:79 = ROTSE1 J145007.78+293858.9

Equatorial coordinates:	**Equinox:**
R.A.= $14^h50^m07.8^s$ **DEC.=** $+29°38'59''$	2000.0

Comparison star(s):	GSC 2022:287

Check star(s):	GSC 2022:219

VAR 3

Name of the object:
GSC 2020:736 = ROTSE1 J145936.69+250244.9

Equatorial coordinates:	**Equinox:**
R.A.= $14^h59^m36.7^s$ **DEC.=** $+25°02'45''$	2000.0

Comparison star(s):	GSC 2020:947

Check star(s):	GSC 2020:902

VAR 4

Name of the object:
GSC 2020:873 = ROTSE1 J145954.54+255434.1

Equatorial coordinates:	Equinox:
R.A.= $14^h59^m54.5^s$ **DEC.=** $+25°54'34''$	2000.0

Comparison star(s):	GSC 2020:1232

Check star(s):	GSC 2020:659

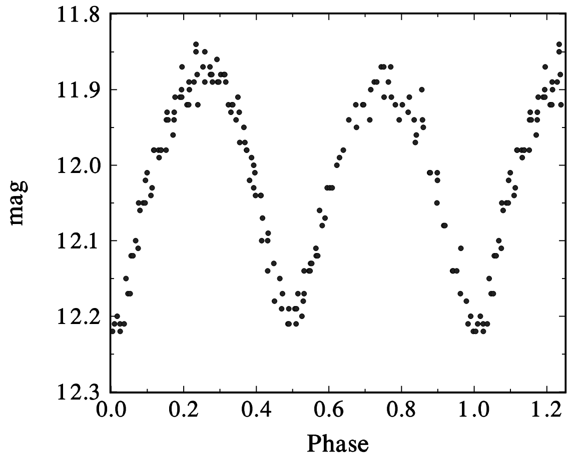

Figure 1. CCD light curve (without filter) of GSC 2016:830

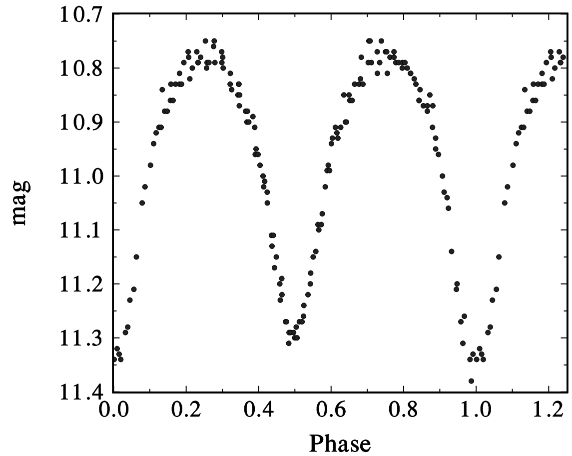

Figure 2. CCD light curve (without filter) of GSC 2022:79

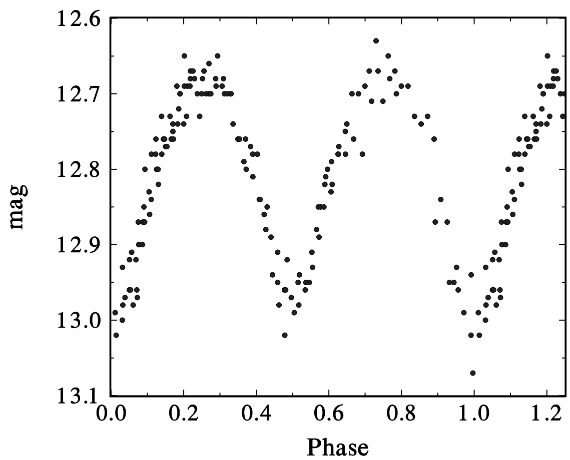

Figure 3. CCD light curve (without filter) of GSC 2020:736

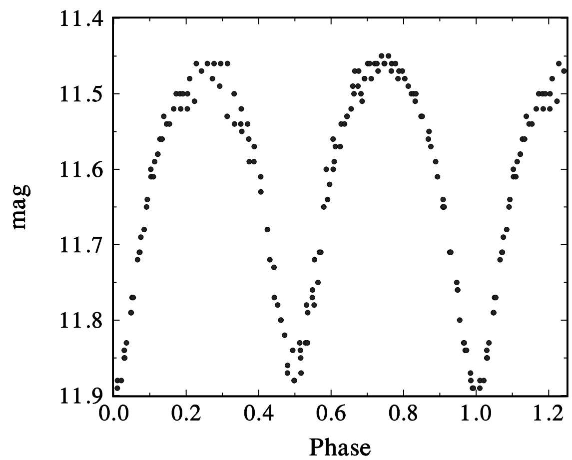

Figure 4. CCD light curve (without filter) of GSC 2020:873

Observatory and telescope:
Private observatory Schüsselacher, Wald, 0.15-m refractor

Detector:	SBIG ST-7 CCD camera

Filter(s):	None

Availability of the data:
Upon request from diethelm@astro.unibas.ch

Type of variability:	EW

Remarks:

As a byproduct of the ROTSE1 CCD survey, a large number of new variables have been discovered (Akerlof et al. 2000). In a series of papers, we report unfiltered CCD observations for some of the close binary systems (type EW) in the list of Akerlof et al. (2000). This installment contains information on four variables in the constellation Bootes. The four stars were observed with our CCD equipment as mentioned above during 5 nights between JD 2451996 and JD 2452041. A total of 162 CCD frames were measured of GSC 2016:830 (VAR 1), 170 frames of GSC 2022:79 (VAR 2), 156 frames of GSC 2020:736 (VAR 3) and 158 frames for GSC 2020:873 (VAR 4). Figures 1 through 4 show our observations folded with the elements

GSC 2016:830: $\mathrm{JD(min,hel)} = 2452001.4032 + 0.361112 \times E$;
GSC 2022:79: $\mathrm{JD(min,hel)} = 2451996.4139 + 0.301601 \times E$;
GSC 2020:736: $\mathrm{JD(min,hel)} = 2452022.5272 + 0.384641 \times E$;
GSC 2020:873: $\mathrm{JD(min,hel)} = 2451996.5840 + 0.376670 \times E$.

These elements of variation are deduced from a linear fit to the newly determined normal minima from the ROTSE1 data (publication in preparation) and the timings of minima derived from our data given in Blättler (2001).

Acknowledgements:

This research made use of the SIMBAD data base, operated at CDS, Strasbourg, France.

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Blättler, E., 2001, *BBSAG Bulletin*, **125**, in preparation

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OBSERVATIONS OF NSV 03799 AND NSV 04612

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VAR 1

Name of the object:
NSV 03799

Equatorial coordinates:	**Equinox:**
R.A.= $07^h54^m20^s\!.1$ **DEC.=** $-00°40'18''$	2000.0

Comparison star(s):	GSC 4833.246

Check star(s):	GSC 4833.611

VAR 2

Name of the object:
NSV 04612

Equatorial coordinates:	**Equinox:**
R.A.= $09^h45^m22^s\!.3$ **DEC.=** $03°57'26''$	2000.0

Comparison star(s):	GSC 239.137

Check star(s):	GSC 239.576

Observatory and telescope:
Observatorio del Departamento de Física de la Universidad de Extremadura, 0.4-m $f/4.5$ Newtonian reflector

Detector:	Starlight Xpress CCD Camera (based in the chip SONY ICX027BL 6.4×4.35 mm^2, 500×256 pixels)

Filter(s):	V (Kron–Cousins system)

Transformed to a standard system:	No

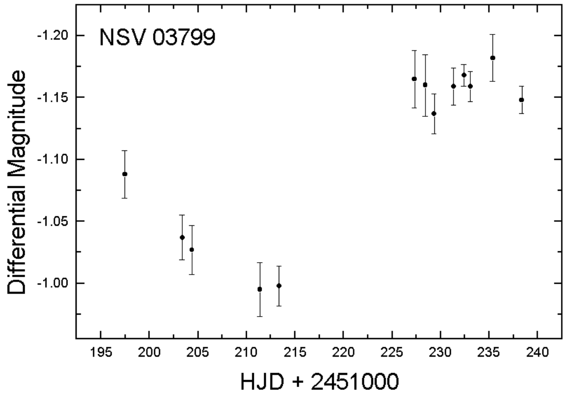

Figure 1. The V light curve obtained for NSV 03799. Delta magnitudes (variable minus comparison) are plotted versus Heliocentric Julian Date

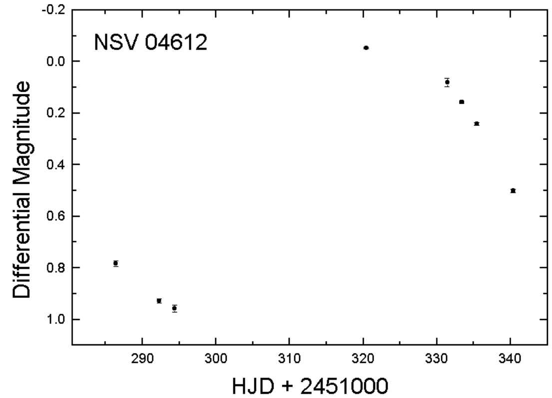

Figure 2. The V light curve obtained for NSV 04612. Delta magnitudes (variable minus comparison) are plotted versus Heliocentric Julian Date

Availability of the data:
Upon request

Type of variability:	SR

Remarks:
Fig. 1 shows the light curve of NSV 3799, obtained during thirteen nights spanning a total of 40 days. The first part of this light curve shows a slow and apparently continuous variation in luminosity, and the last set of observations denote a relatively constancy of brightness with small deviations. The shape of the light curve of NSV 3799 and its spectral type M5 (Kukarkin et al. 1982), allow us to give a preliminary classification as SRb variable, although a possible designation as a SRc star cannot be discarded from the observations if it were a supergiant. Fig. 2 shows the light curve of the variable NSV 4612, obtained on eight nights spanning a total of 54 days. In this light curve a variation in luminosity of around 1 magnitude is observed. The brightness changes are continuous and, furthermore, it is possible that the light curve could follow a sinusoidal shape, typical of SRa stars, although the gap existing between HJD 2451295 and 2451320 does not allow us to assure this assumption. Its spectral type M (Kukarkin et al. 1982) and the shape of the light curve allow us to give a preliminary classification as an SRa or SRb variable.

Acknowledgements:
This research was supported by the Consejera de Educación, Ciencia y Tecnología (Junta de Extremadura) under project IPR00A026.

Reference:

Kukarkin, B.V. et al., 1982, New Catalogue of Suspected Variable Stars, Moscow

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SHORT-TERM RADIO VARIABILITY OF CYGNUS X-1

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In this note we report high time resolution radio photometry of the high mass X-ray binary and classical black hole candidate Cygnus X-1. The results presented here are a by-product of an observational program carried out several years ago. At that time, our primary goal was to obtain high sensitivity images of the extended radio emission around Cygnus X-1 (Martí et al. 1997). In addition to these results, the observed data can provide a radio light curve of Cygnus X-1 with time resolution of a few minutes and extending for several hours. The short-term variability of Cygnus X-1 remains practically unexplored at radio wavelengths. Therefore, we are confident that the data presented in this note will help improve this situation.

The radio counterpart of Cygnus X-1 was originally discovered by Tananbaum et al. (1972) and Hjellming (1973). At centimetric wavelengths, this source has a rather stable radio emission at the 10–20 mJy level with a very flat spectral index (Fender et al. 2000). The radio luminosity of the system displays a $\sim 30\%$ amplitude modulation with the orbital period of 5.6 d, together with a long-term modulation on time scales of 150 d (Pooley et al. 1999). Here we study the Cygnus X-1 radio light curve with time resolution much higher than in most previous studies.

Our observations were carried out on 1996 April 11 (JD 2450185) with the interferometer Very Large Array (VLA) of the National Radio Astronomy Observatory (NRAO) in New Mexico (USA). The array had its 27 antennas in its C configuration and operated at the wavelength of $\lambda = 6$ cm. In this configuration, the longest baselines extend over 3.4 km equivalent to 57 kλ thus providing an angular resolution of about $4''$. The data were processed using the AIPS package of NRAO following the common procedures for connected radio interferometry. The amplitudes of the visibilities were calibrated by observing 1331+305 for a few minutes at the beginning of the run. The adopted flux density at 6 cm of this VLA primary calibrator is close to 7.5 Jy. We also observed the unresolved source 2007+404, before and after each of the Cygnus X-1 scans, to be used as the phase calibrator. Cygnus X-1 was found to be bright enough to self-calibrate its visibility data in phase using a simple point source model. This step allows us to get rid of most atmospheric phase instabilities. Our final radio light curve has been produced using the AIPS task DFTPL applied on the self-calibrated data. This task performs the

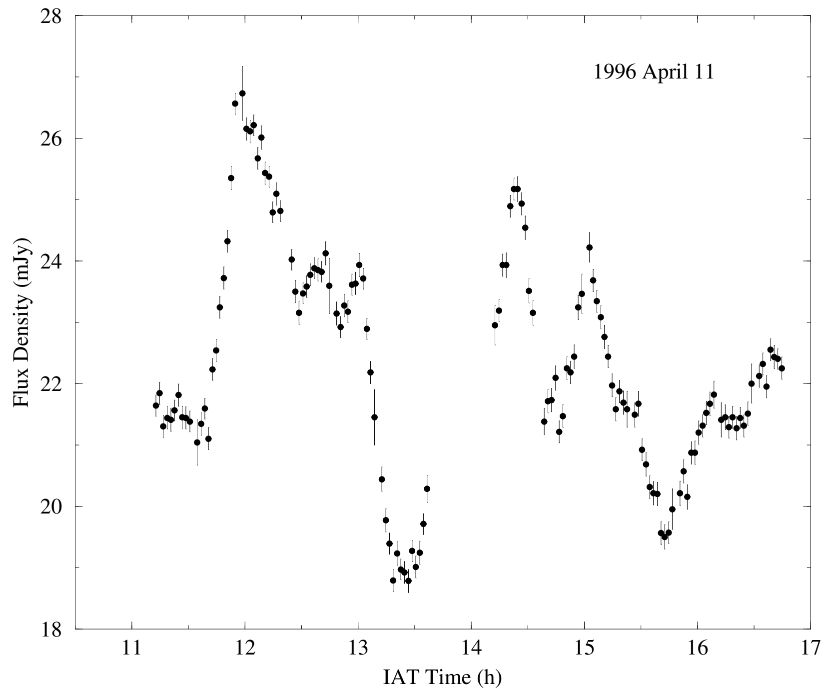

Figure 1. Radio light curve of Cygnus X-1 at the wavelength of 6 cm on 11 April 1996. The data points have been averaged every 120 s. The source has a variability amplitude of $\sim 30\%$ on time scales of one hour. The horizontal axis is labelled in International Atomic Time (IAT) whose difference with Universal Time in 1996 was close to 30 s

direct Fourier transform of the measured visibilities as a function of time for an arbitrary point in the sky, i.e., the Cygnus X-1 position in our case. This Fourier transform is a real quantity that gives the flux density of any point source at that point. No significant nearby confusing sources were present in the array field of view, that is limited by the beam of the individual antennas (FWHM $\sim 10'$). In fact, Cygnus X-1 was the brightest source in the field of view.

In Fig. 1, we present the final radio light curve of Cygnus X-1 for several hours in 11 April 1996. The radio emission of the system is clearly variable with several radio flares in time scales of hours. The variability amplitude observed is close to $\sim 30\%$. This is remarkably similar to that exhibited by Cygnus X-1 during its X-ray flares, which often last from hours to days. The only X-ray coverage of Cygnus X-1 simultaneous with our radio data is that provided by the All Sky Monitor (ASM) on board the Rossi X-ray Timing Explorer satellite posted on the web. Unfortunately, the ASM fluxes are too scarce to check if there is any correlation or anti-correlation between radio and X-ray variability at this time resolution.

The plot in Fig. 1 also suggests a possible recurrence period of the radio flares close to 1 h. These flaring events are also reminiscent of the radio and infrared oscillations observed in the microquasar GRS 1915+105 (see e.g. Mirabel et al. 1998). These events are interpreted in terms of repeated ejections of pairs of relativistic synchrotron emitting plasmons every half an hour or so. It is thus very likely that we are seeing the same phenomenon in Cygnus X-1. The rise time of an individual flare is about 20 minutes with an amplitude of ~ 5 mJy. From light travel time arguments, this implies an upper limit of 3.6×10^{13} cm (2.4 AU) for the size of the radio emitting region. At a distance of 2.5 kpc and assuming a flat spectral index, the corresponding brightness temperature is $\geq 4\times10^8$ K, i.e., consistent with non-thermal synchrotron emission. Further concurrent radio and X-ray observations with high time resolution are required to better clarify the tentative suggestions of this paper. The hypothesis of repeated ejection of synchrotron plasmons will be tested in the future, when the very sensitive Expanded Very Large Array (EVLA) becomes available.

Acknowledgements: JM acknowledges partial support by DGICYT (PB97-0903) and by Junta de Andalucía (Spain). The National Radio Astronomy Observatory is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc. We also thank S. Chaty (Open University, UK) for valuable discussions on this work.

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SUPERHUMP IN NOVEMBER 2000 SUPEROUTBURST OF TY PISCIUM

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The SU UMa type dwarf nova TY Psc was found in bright state on 28 Nov 2000 by J. Ripero (vsnet-campaign 545:

http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-campaign/msg00545.html

and vsnet-superoutburst 66:

http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-superoutburst/msg00066.html).

It was then observed photometrically using small telescopes equipped with V filter, which resembles Johnson V filter and cooled CCD camera in three sites:

1. Kyoto University on October 30, 2000, using 25-cm Schmidt–Cassegrain, with ST-7 CCD camera.
2. Ouda Station, Kyoto University, on November 1, 2000, using 60-cm Cassegrain with PixelVision camera (SITe SI004AB, Cryo Tiger-cooled) and Rc filter.
3. Gunma Astronomical Observatory on November 3, 2000, using 25-cm Newtonian with cooled Bitran 11 CCD camera and V filter.

The exposure time was 30 seconds in Kyoto and Ouda, and around 25 to 40 seconds in GAO observation depending on the altitude of the object. Ouda data were reduced using IRAF APPHOT package. To correct for the readout noise, the object frames were subtracted by bias frames and for flat fielding we used twilight frames. GAO and Kyoto data were reduced by Java^{TM}-based aperture photometry package developed by one of the author (TK). The readout and thermal noise was removed by dark frame subtraction and flat fielding was done using twilight frames.

Due to unstable weather condition, some of the Kyoto and Ouda data has to be rejected. The criterion for the rejection was one of the following conditions: (1) the count of the comparison star drop to less than 25% of the average count or (2) the count is more than 25% of average count but dropped suddenly more than 25% of those in the previous frame. Figure 1 shows the resulting light curve, the ordinate is the magnitude of the star relative to a comparison star. The comparison star used for differential photometry in

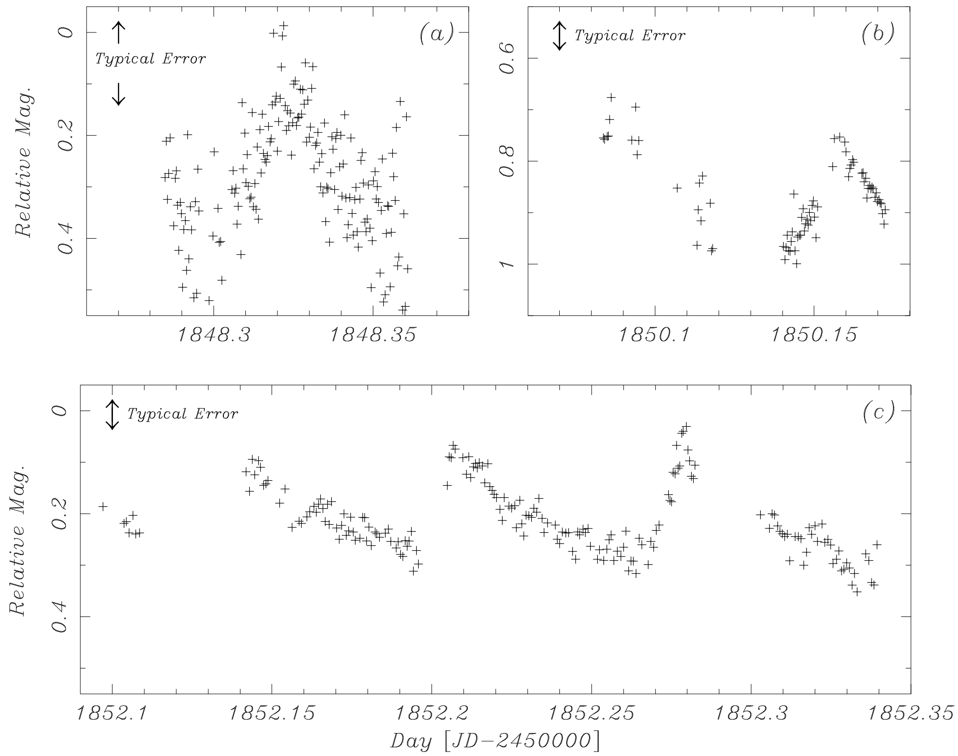

Figure 1. Light curves of TY Psc obtained at (a) Kyoto, (b) Ouda, and (c) Gunma

Ouda data is a $12^{\mathrm{m}}_{\cdot}36$ star GSC 2296.1010, GAO and Kyoto data is a $12^{\mathrm{m}}_{\cdot}49$ star GSC 2296.1213.

The trend of the data from each site was removed using straight-line fitting. The three sets of data were then combined to form one data set. Similar trend removal procedure was applied once again to the combined data to remove the influence of observational environment difference. The final combined and corrected data were then analyzed using Phase Dispersion Minimization method (Stellingwerf, 1978), which was implemented into PDMWIN 3.0 computer program wrote by Widjaja (1996). The resulting θ diagram is presented in Figure 2.

From Figure 2 we can estimate the most probable period, that is about 102 minutes. To get a more precise period determination we took part of Figure 2 that is the valley around 102 minutes period and fit it to a parabolic curve. The minimum of the parabola occurs at the trial period 0.0708 day or 101.9 minute. Using this value we construct the folded light curve and present in Figure 3. This graph shows a usual superhump light curve, that is a steeper brightening followed by slower dimming.

We used full width half maximum of the deepest valley of the θ diagram as the error of the period determination. Then the estimated error of the superhump period found is 0.4 minutes.

In this work we could confirm and refine previous superhump period estimation of TY Psc quoted by Szkody and Feinswog (1988). Despite unfavorable weather in two observation site, the period determination was relatively accurate. This is the consequence of long time covering (4 days) so that slight change in trial period will cause significant difference in θ (see Figure 2). Therefore long time covering is recommended for accurate determination of superhump period, provided there is no phase change between observations. Recalling the 98.4 minutes orbital period found by Thorstensen et al. (1996), this

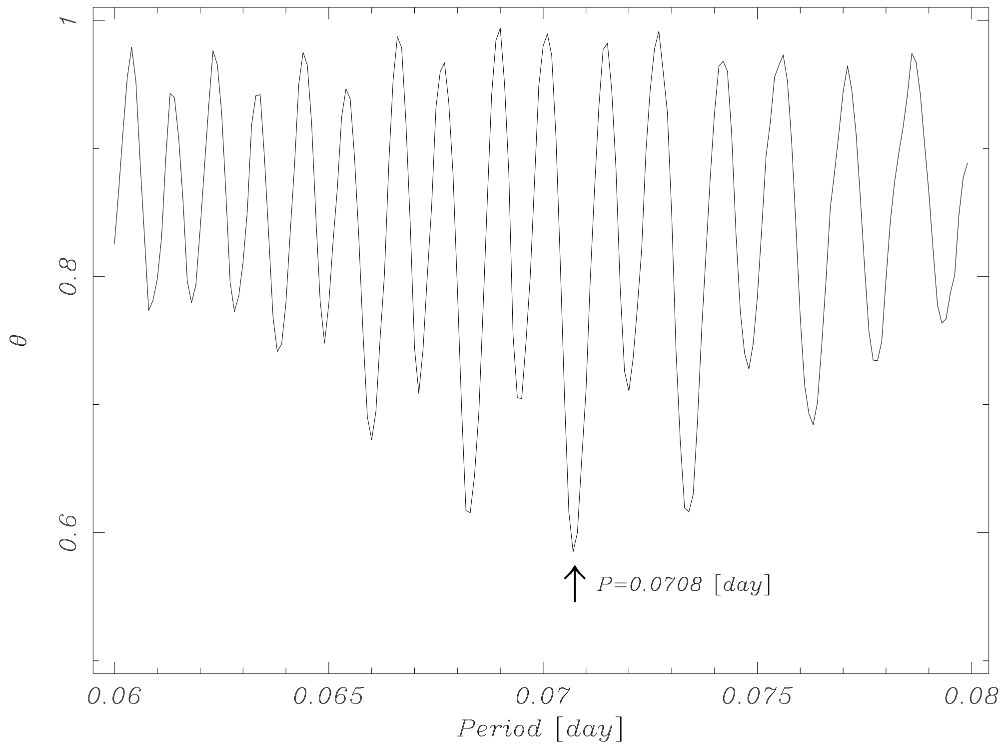

Figure 2. θ diagram of the period analysis of the combined data

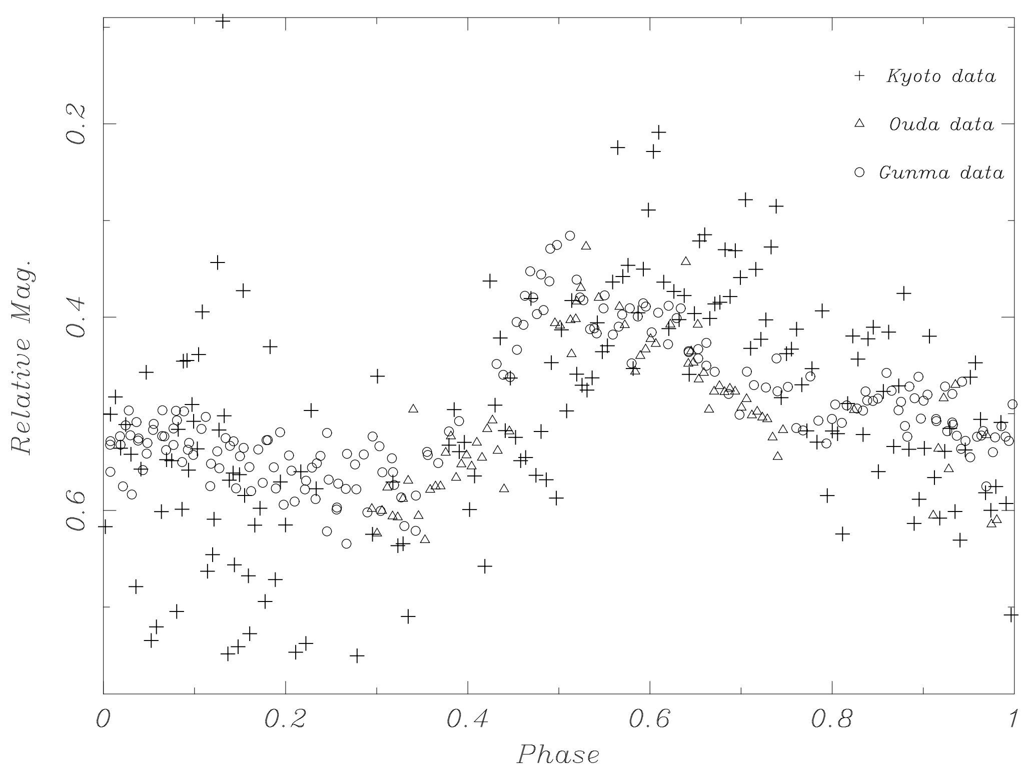

Figure 3. Folded curve of the combined data

superhump period is 3.6% longer than the orbital period which is quite normal for SU UMa type dwarf novae.

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Widjaja, A., 1996, http://www.kusastro.kyoto-u.ac.jp/vsnet/etc/prog.html

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THE FIRST GROUND-BASED PHOTOMETRIC OBSERVATIONS OF V397 CEPHEI

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Name of the object:
V397 Cep = BD +72°1136 = HIP 270 = HD 225093

Equatorial coordinates:	**Equinox:**
R.A.= $00^h03^m24\overset{s}{.}01$ **DEC.=** $+73°10'28\overset{''}{.}2$	2000

Observatory and telescope:
TÜBİTAK National Observatory, 40-cm Cassegrain telescope

Detector:	Hamamatsu, R 4457 (PMT)

Filter(s):	Johnson U, B and V

Comparison star(s):	BD +72°1135 = HIP 128

Check star(s):	BD +72°12 = HD 1176

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	EA

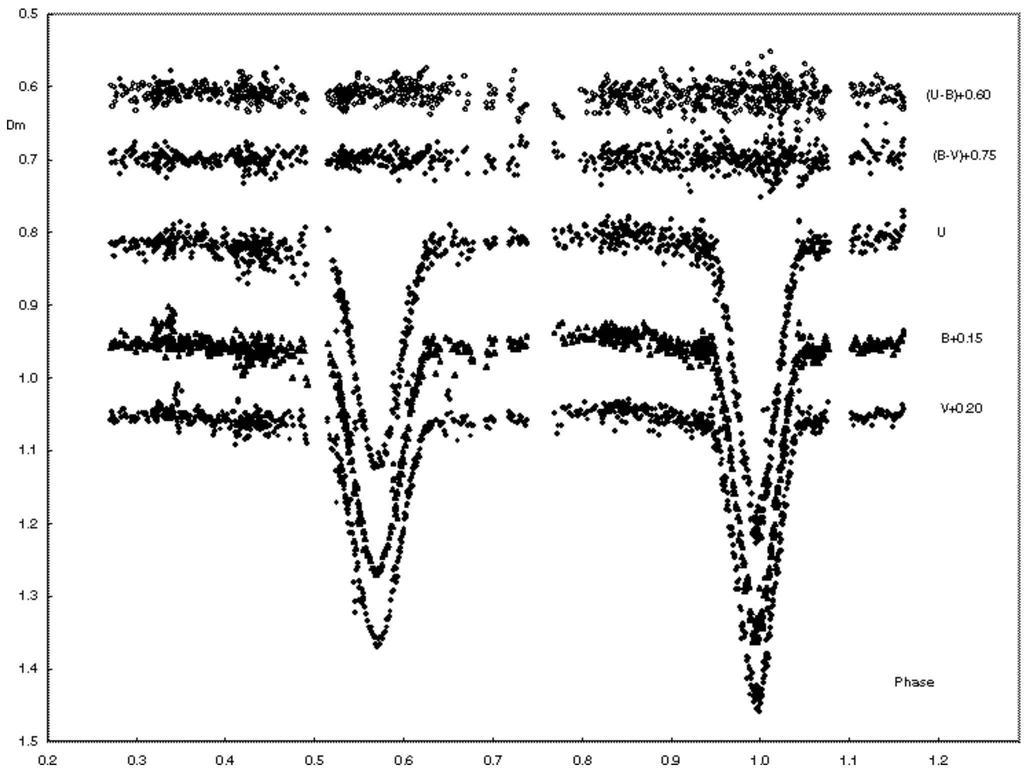

Figure 1. U, B and V light, and $U-B$ and $B-V$ color curves of V397 Cep. The color curves do not seem to have any variation

Remarks:

The variability of V397 Cep was discovered by HIPPARCOS (ESA, 1997). The photometric observations of the system by HIPPARCOS show an Algol type light curve with an amplitude of $0\overset{m}{.}418$. The visual magnitude of the system varies between $7\overset{m}{.}393$ and $7\overset{m}{.}811$. The mean orbital period derived from the best HIPPARCOS light curve fit is $2\overset{d}{.}08684$ and the epoch of minimum light is given as HJD 2448501.1800 (ESA, 1997). The spectral type of the system is given as A2. The first ground-based photometric observations were made over 11 nights during 2000 observing season at the TÜBİTAK (Scientific and Technical Research Council of Turkey) National Observatory. The light and color curves, which were obtained by these observations, are given in Figure 1. New light curves show that the secondary minimum clearly lies not at the phase of 0.5 as usually expected, but shifted to the phase of 0.573. The asymmetry and duration of both minima are quite different. Therefore, the orbit of the binary should be quite eccentric and the system should be a good candidate for eclipsing binaries with apsidal motion. Further observations of the system are needed in finding the apsidal motion parameters.

Acknowledgements:

We acknowledge the observing time at the TÜBİTAK National Observatory. This work was supported by Çanakkale Onsekiz Mart University Research Fund.

Reference:

ESA, 1997, The Hipparcos and Tycho Catalogues, SP–1200

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GSC 4431_1446, A NEW RED VARIABLE IN DRACO

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Name of the object:
GSC 4431_1446

Equatorial coordinates:	**Equinox:**
R.A.= $19^h06^m52.^s7$ **DEC.=** $+68°26'26.''2$	2000.0

Observatory and telescope:
L'Estelot Observatory 0.31-m Newtonian telescope; Mollerussa 0.26-m Schmidt–Cassegrain telescope

Detector:	CCD

Filter(s):	*V*

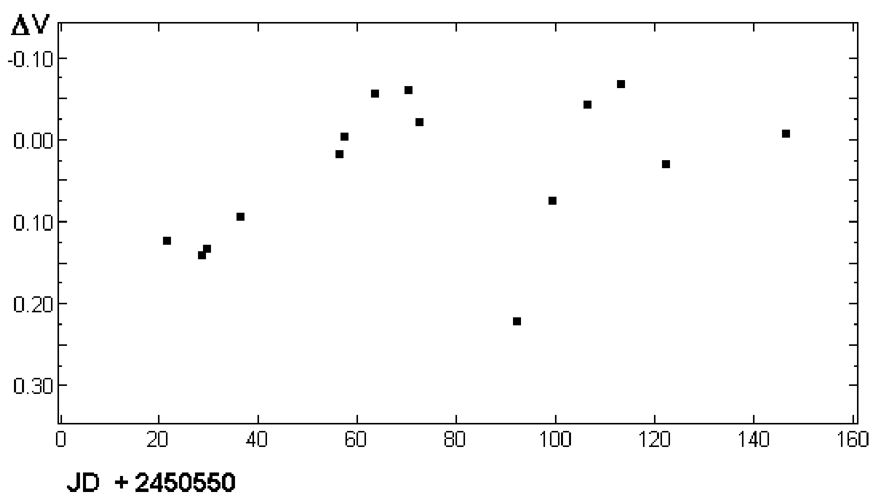

Figure 1. Observations from l'Estelot Observatory in 1996

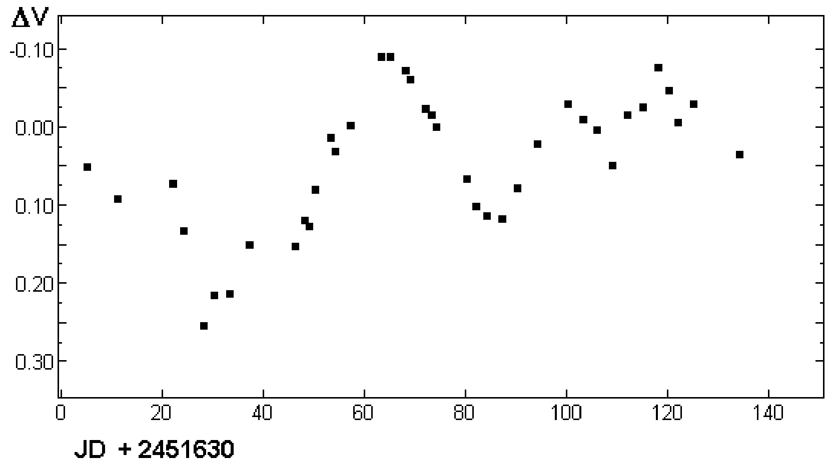

Figure 2. Observations from Mollerussa in 1999

Availability of the data:
Upon request

Type of variability:	SR

Comparison star(s):	GSC 4431_386 = TYC 4431 00386 1

Transformed to a standard system:	No

Remarks:
The variability of GSC 4431_1446 was discovered from l'Estelot Observatory (Figure 1) while photometrically monitoring NSV011766 (Garcia-Melendo and Nomen-Torres, 2000). CCD frames taken in the BVR_cI_c bands showed that this star is a red object. To obtain more information about its behaviour, GSC 4431_1446 was observed from Mollerussa in 1999 (Figure 2). This additional set of data showed that it is a low amplitude red variable. If the V magnitude of the comparison star computed from Tycho photometric data is taken into account (ESA 1997), our photometric measurements indicate a 0.34 V magnitude variation between $11\overset{m}{.}02$ and $11\overset{m}{.}36$. Nevertheless, due to its redness, colour transformations should be applied after performing multiband standard photometry to obtain more reliable standard magnitudes. After performing a preliminary period analysis strong peaks around 57 and 60 days were found in the periodograms. This result is somewhat uncertain because the observing time intervals are too short to obtain the true pulsation period for this star.

References:

ESA, 1997, The Hipparcos and Tycho Catalogues, ESA SP-1200
Garcia-Melendo, E., Nomen-Torres, J., 2000, *IBVS*, No. 4974

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OPTICAL MONITORING OF THE X-RAY SOURCE QR And/RX J0019.8+2156

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QR And was identified as an optical counterpart of the supersoft X-ray source RX J0019.8+2156 by Beuermann et al. (1995). It is a close eclipsing binary with the orbital period of 15.85 hours. QR And displays both a complicated orbital photometric modulation with an amplitude of about 0.5 mag and long-term variations by up to 2 mag (Greiner and Wenzel 1995, Will and Barwig 1996). In addition, rapid fluctuations on the time scale of an hour are superposed on the orbital modulation (e.g. Meyer-Hofmeister et al. 1998). The properties of QR And are commonly understood in terms of the model for the supersoft X-ray sources by van den Heuvel et al. (1992) which supposes a steady-state thermonuclear burning of the accreted matter on the surface of the white dwarf in a binary. A large part of the luminosity in the optical region is due to irradiation of the disk and the companion star by the white dwarf. The optical activity was interpreted in terms of variations of the accretion disk with a high rim (Meyer-Hofmeister et al. 1997).

QR And has been monitored in the framework of the observational campaign of the MEDÚZA group of the Variable Star Section of CAS, started in 1998. Here we report just the CCD observations in the V passband. They were obtained at Brno Observatory with Newton 400/2250 mm, equipped with the CCD camera SBIG ST-7, and at Hradec Králové Observatory using Newton 250/1250 mm and CCD camera SBIG ST-5.

Series of densely spaced measurements, covering up to several hours, were secured in most nights, the typical exposure time being 1 minute. The variable, the comparison star and the check star were placed in the same image. The typical standard deviation of the measurements is about 0.02 mag(V). The comparison star was identical to that used by Matsumoto (1996), having $V = 13.01 \pm 0.01$.

All CCD observations were folded with the orbital period according to several ephemerides. The ephemeris by Greiner and Wenzel (1995) which was valid between the years 1955–1993 did not yield good result. The primary minimum of the folded CCD light curve tended to occur too late and did not coincide with phase 0.0. Although our observations did not cover the primary minimum completely this phase shift was well visible. On the other hand, the ephemeris by Will and Barwig (1996). $T(\mathrm{min.\,I}) = 2448887.509 +$

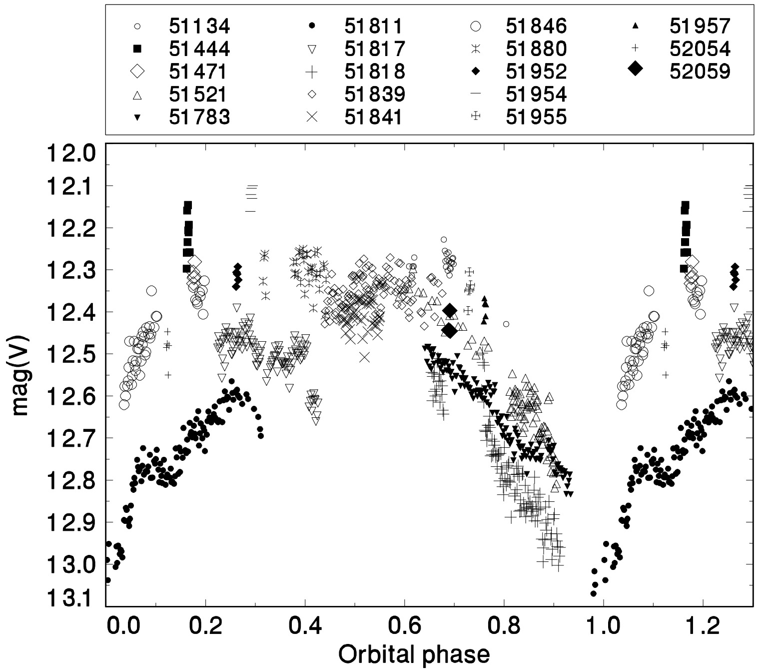

Figure 1. Orbital modulation of QR And in the V-filter over the years 1998–2001. The respective runs are resolved. The orbital ephemeris by Will and Barwig (1996) was used. See text for details

$0.6604721\times E$, yielded better agreement (Fig. 1). It can be seen that the primary minimum of the folded light curve plausibly agrees with phase 0.0 now. Our observations therefore speak in favour of shortening the orbital period, first revealed by Will and Barwig (1996).

The scatter of the folded light curve of QR And in Fig. 1 is appreciable and also the shape of the modulation differs from the curves published previously. For example the folded light curve by Matsumoto (1996; his Fig. 1), composed of the data secured during the year 1995, displays a higher brightness before phase 0.5 than after it. On the contrary, our observations form a curve which is rather scattered within phases 0.2–0.7. This difference and scatter are caused mainly by the long-term changes, as can be seen from a comparison of the courses in the respective nights; variations as large as 0.5 mag(V) are apparent near phase 0.2 (Fig. 1). Notice the prominent variations of the rise from the primary minimum. There is a clearly apparent bump on egress at phase approx. 0.1 when the level of out-eclipse brightness is low. On the other hand, this feature is absent when QR And is generally brighter. This phenomenon may be tentatively interpreted in terms of variations of the profile of the elevated disk rim. The model by Meyer-Hofmeister et al. (1998, their Figs. 2 and 3) shows that in principle this bump may be produced if the rim is less pronounced in a lower state. The height of the rim depends on the mass transfer rate.

The amplitude of the orbital modulation in QR And over the interval covered by our observations is comparable to that of the long-term changes and it makes them less discernible. However, if we limit ourselves to the out-eclipse observations and divide the light curve into phase intervals then the long-term variations can better be assessed. Because the previous analyses revealed that the orbital light curve of QR And is asymmetric (ingress into primary eclipse is longer than egress (e.g. Will and Barwig 1996, Matsumoto 1996)) we will use the phases 0.1–0.8 only. The result is shown in Fig. 2 where each point

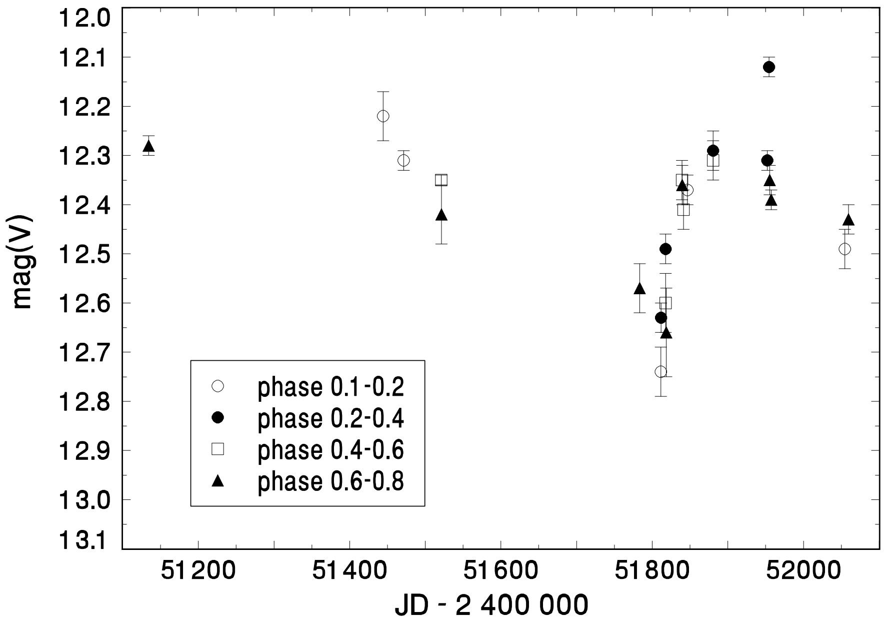

Figure 2. Long-term variations of QR And in the V-filter over the years 1998–2001. Only the out-eclipse data, divided into phase intervals, were used to suppress the influence of the orbital modulation. Each point represents the mean brightness in each bin in a given night. The error bars denote the standard deviations. See text for details

represents the mean brightness in each bin in a given night. Both the real changes and the observational noise contribute to the standard deviation of each bin, marked in Fig. 2. It can be seen that QR And underwent an episode of a shallow low state; the rapid rise from it can clearly be resolved.

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Meyer-Hofmeister, E., Schandl, S., Deufel, B., Barwig, H., Meyer, F., 1998, *A&A*, **331**, 612

van den Heuvel, E.P.J., Bhattacharya, D., Nomoto, K., Rappaport, S.A., 1992, *A&A*, **262**, 97

Will, T., Barwig, H., 1996, Workshop on Supersoft X-ray Sources, Garching, ed. J. Greiner, Lecture Notes in Physics No. 472, Springer Verlag, p. 99

COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

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3 July 2001

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NSV 2544 Cam: A W UMa TYPE ECLIPSING BINARY

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NSV 2544 (= Zi402 = CSV 635 = GSC 4344.123; $\alpha = 05^{\rm h}43^{\rm m}05^{\rm s}$, $\delta = +68^\circ 40' 07''$ [J2000]) was first noted as a variable star on the basis of visual observations by Yendell (1894), suggesting long period nature of the object. Böhme (1937) gives additional photographic observations suggesting variability between 11.3 and 12.5 mag and an approximate period of 20 days with a note that not all observations can be folded with this period. Mayall (1951a) announced an independent discovery of the same object, which she later (Mayall 1951b) identified with a star now catalogized as GSC 4344.697. However, Jefremov (1963) examined 20 photographic plates and clearly showed that the real variable is another star (GSC 4344.123) with range 10.9 to 11.9 mag. Unfortunately, the wrong identification of Mayall (1951b) is still persisting in the literature. Close vicinity of NSV 2544 is shown in Figure 1.

NSV 2544 was chosen for visual monitoring on the basis of the PROSPEKTOR catalogue which contains eclipsing binaries lacking precise elements in the literature (Haltuf 2001). Using visual estimates of one of us (MH) carried out with a 15 cm Dobsonian telescope at his private observatory at Kolin, we preliminary concluded that NSV 2544 is probably a β Lyr type eclipsing binary.

We have done CCD photometry conducted by ML at Hradec Králové observatory using a 25 cm telescope and SBIG ST-5 CCD camera, by PS at Nicholas Copernicus Observatory (Brno) with a 40 cm telescope employing SBIG ST-7 CCD camera and by LŠ at Valašské Meziříčí Observatory using an Astrokamera 120/540 mm (Carl Zeiss Jena) and an SBIG ST-7 CCD camera, respectively. All observatories have used V band filters from the same manufacturer, which were proven to be closely matched to the standard Johnson one. Each observatory have used different comparison stars, which were found constant using nearby check stars. Further observations were done visually by one of us (OP) using a 25 cm Dobsonian telescope at his private observatory at Brno. We obtained a total of 1183 CCD frames of NSV 2544. All data are available upon request.

From our CCD observations we conclude that NSV 2544 really is GSC 4344.123 and either a β Lyr or a W UMa type eclipsing binary. Depth of primary minima is 0.63 mag and depth of secondary minima 0.44 mag in V band. We were also able to derive 13 times

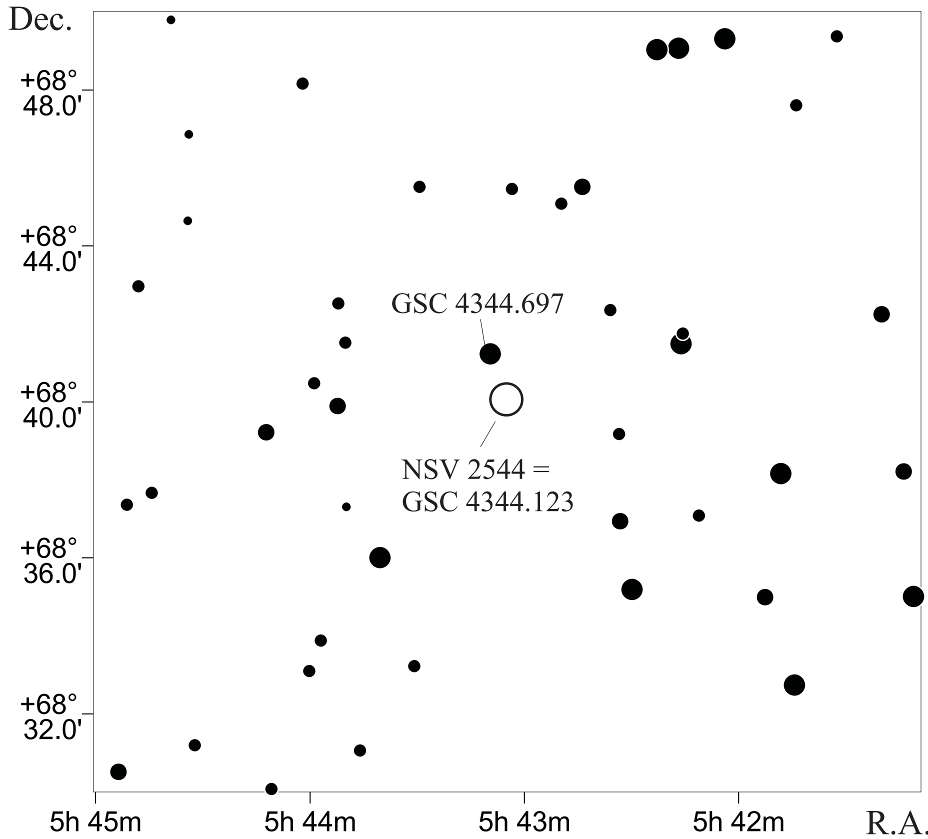

Figure 1. Close vicinity of NSV 2544 based on the GSC catalogue showing also the former wrong identification. Coordinates are J2000

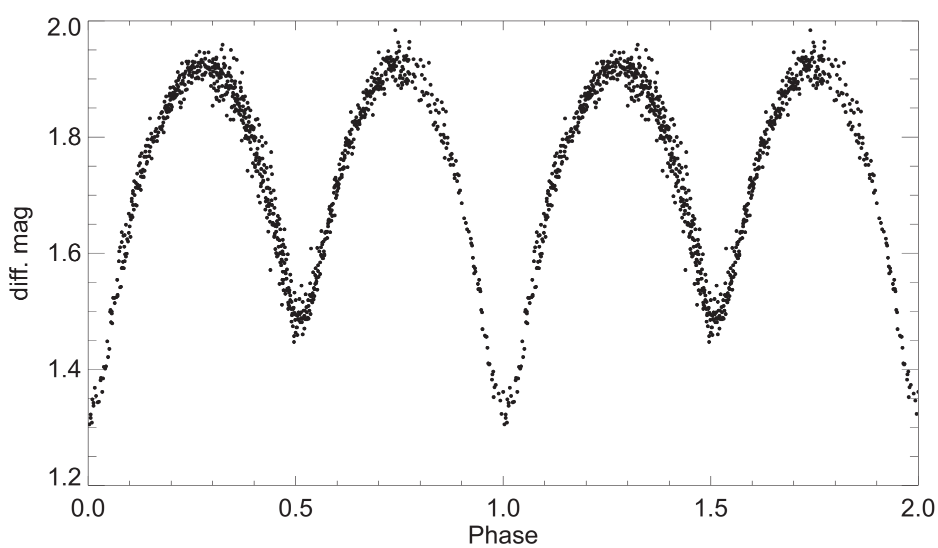

Figure 2. Our phased CCD V band light curve of NSV 2544

of minimum light seen in Table 1, which were determined using Kwee and Van Woerden method implemented in AVE (Barbera 2000). As secondary minima occur almost exactly at the phase 0.5, analysis of both primary and secondary minima yields to the following ephemerides:

$$\begin{array}{rl}\text{Min. I} = \text{HJD } 2451975.6040 + & 0.4341474 \times E. \\ \pm 0.0006 & \pm 0.0000043\end{array}$$

The best observed primary minimum was chosen as the basic one. Errors of minima time determination were treated as weights, error of $0.004^{\mathrm{d}}$was attributed to all minima based on visual observations. Our phased V band light curve is shown in Figure 2. The fact that different comparison stars have been used at each observatory have been eliminated by empirical shifts of the zero points.

We have computed a preliminary (due to the fact we have data only in V passband) model of the binary using programme Nightfall (Wichmann 2000). The inclination angle is $i = (74 \pm 2)^\circ$ and the filling factor of both components (1.06 ± 0.02) suggests overcontact binary of the W UMa type. We haven't been able to find any reasonable solution with filling factor lower than 1.

Table 1: Minima timings of NSV 2544

Hel. JD	Error	Type	$O-C$	Observer	Remarks
2451956.287	0.004	Min II	0.003	MH	visual
2451965.394	0.003	Min II	−0.007	LŠ	CCD, uncertain
2451965.6204	0.0003	Min I	0.0018	ML	CCD
2451968.4381	0.0007	Min II	−0.0025	ML	CCD
2451968.6559	0.0006	Min I	−0.0017	ML	CCD
2451971.4800	0.0006	Min II	0.0004	ML	CCD
2451975.3873	0.0003	Min II	0.0005	ML	CCD
2451975.6040	0.0006	Min I	0.0000	ML	CCD, basic minimum
2451980.387	0.004	Min I	0.007	OP	visual
2452000.352	0.004	Min I	0.002	OP	visual
2452005.334	0.004	Min II	−0.009	OP	visual
2452024.4456	0.0002	Min II	0.0000	PS	CCD
2452024.4466	0.0007	Min II	0.0011	ML	CCD

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This paper is a result of cooperation of the Czech observatories and astronomers working in the observing programmes of the Czech Astronomical Society, namely B.R.N.O. (http://var.astro.cz/brno/) and MEDÚZA (http://www.meduza.org/).

This work has made use of the SIMBAD database, operated at CDS, Strasbourg, France. The NASA ADS Abstract Service was used to access data and references.

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VARIABILITY OF LUYTEN'S GM Sgr

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Name of the object:
GM Sgr (Luyten's GM Sgr, in order to avoid confusion with V4641 Sgr, which had been called as GM Sgr)

Equatorial coordinates:	**Equinox:**
R.A.= $18^h19^m21\overset{s}{.}4$ **DEC.=** $-25°25'37''$	J2000.0

Observatory and telescope:
25-cm Schmidt–Cassegrain telescope at Kyoto University

Detector:	ST-7 camera
Filter(s):	None
Comparison star(s):	GSC 6848.3882 (Tycho $V = 9.30$, $B - V = +0.49$)
Check star(s):	GSC 6848.3606
Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	M

Remarks:
We continued CCD photometry using the same instruments and photometric procedures described in Kato and Uemura (1999). Observations were done on 112 nights between 1999 August 24 and 2001 June 11. The resulting light curve is shown in Figure 1, which clearly shows long-period variation. Figure 2 shows the folded light curve using the ephemeris JD(max) $= 2451473 + 212 \times E$. The figure shows a typical light curve of a Mira-star, having a nearly sinusoidal light curve. In conclusion, GM Sgr is a short-period Mira-type variable star with a period of 212 d.

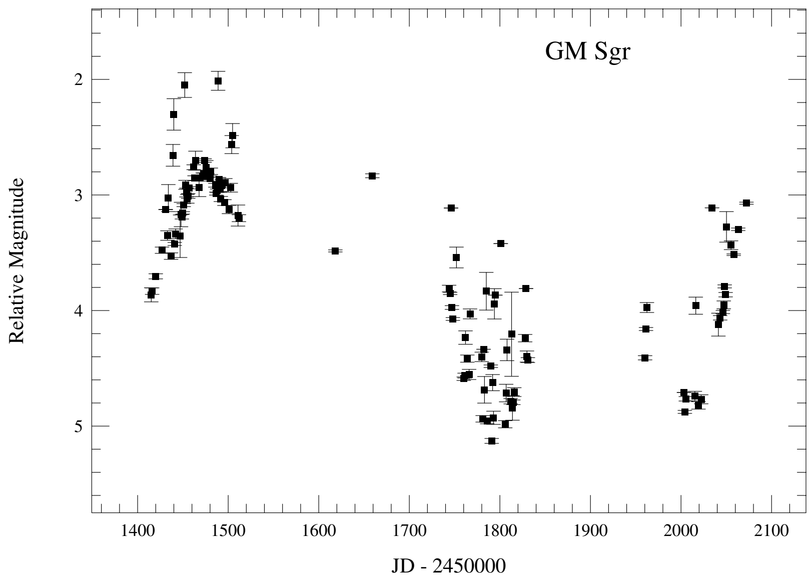

Figure 1. Light curve of GM Sgr

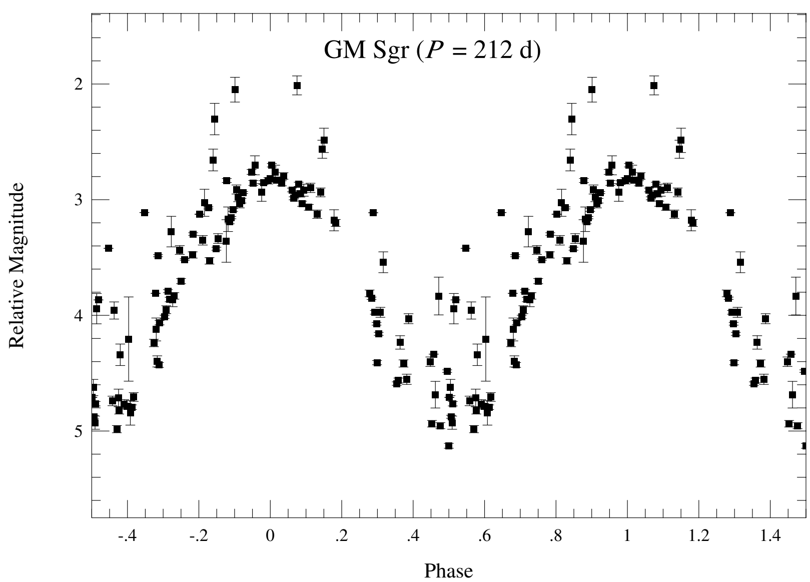

Figure 2. Folded light curve of GM Sgr

Acknowledgements:

Part of this work is supported by a Research Fellowship of the Japan Society for the Promotion of Science for Young Scientists (MU, KM).

Reference:

Kato, T., Uemura, M., 1999, *IBVS*, No. 4795

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IDENTIFICATION OF KNOWN AND SUSPECTED VARIABLES FROM THE ROTSE1 SURVEY

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Akerlof et al. (2000) published a list of 1781 variables discovered by the ROTSE1 (Robotic Optical Transient Search Experiment 1) survey. The complete catalog is available through http://www.umich.edu/~rotse . By comparing the positions of these stars with positions of known variable stars from the General Catalogue of Variable Stars (GCVS) to within 28.″8, they identified about 10% of the stars on their list as known variables. However, the precision of the positions of some stars in the GCVS is not better than 1′. Therefore the identification done with GCVS variables cannot be complete.

By visually inspecting computer plots of the positions of the ROTSE1 stars against stars from the GCVS and the New Catalogue of Variable Stars (NSV), and verifying candidates with the type of variability and the magnitude and period if possible, 170 additional identifications were done which are not registered in the Simbad database (operated at CDS, Strasbourg, France, http://simbad.u-strasbg.fr/). The list is produced in Table 1.

The GCVS stars may be up to 5′ off the ROTSE1 positions. In fact, the ROTSE1 catalog provides a more accurate position for these stars than the GCVS. For some of them, more precise positions have already been determined before in other papers. The position given by Kinnunen and Skiff (2000a) for IX Lyr lies about 0.′5 south of the ROTSE1 position, and that for OS Her (Kinnunen and Skiff, 2000b) 0.′5 to the north.

Some stars appear twice in the ROTSE1 catalog, with a slightly different position (probably because they appear in the region of two overlapping frames). The known variables that correspond to these stars will in this case appear twice in Table 1.

Table 2 provides an overview of the number of ROTSE1 variables that are not present in the GCVS or the NSV, for which an identification exists in the Simbad database, and which have been identified in this paper, according to the ROTSE1 classification of variability.

The technique used by ROTSE proves to be very efficient in the discovery of new variables. For short period variables it gives an immediate estimate of the period (see also Diethelm 2001, for ephemerides of the new eclipsing binaries discovered by ROTSE). It may also be valuable in the monitoring of long period variables, which has been the almost exclusive terrain of visual observers until now. A large number of maxima and minima of Mira variables may be calculated from the CCD data.

P. Lampens and P. Van Cauteren are acknowledged for stimulating discussions.

Table 1: New identifications of known variables and suspected variables from the ROTSE1 survey

ROTSE1	GCVS	ROTSE1	GCVS
J124004.01+273014.0	U Com	J170831.41+183116.7	V458 Her
J124055.05+370507.0	SW CVn	J170913.29+143807.7	NSV 8243
J125110.42+325808.3	AP CVn	J171049.24+125250.4	V461 Her
J125421.57+321433.3	TY CVn	J171110.02+230011.1	V462 Her
J130236.85+311822.9	FQ Com	J171110.07+230009.2	V462 Her
J132942.14+285248.2	VW CVn	J171134.15+233630.5	V464 Her
J133430.88+291815.5	WW CVn	J171232.71+402826.1	V725 Her
J133455.38+262700.2	BT Com	J171249.56+250150.5	V467 Her
J134844.63+334335.3	RT CVn	J171250.06+250149.1	V467 Her
J140258.07+253211.8	BH Boo	J171339.95+205849.5	V468 Her
J140601.69+243413.2	CS Boo	J171432.90+100536.8	V904 Oph
J144739.80+255828.6	NSV 6808	J171446.79+100455.7	V905 Oph
J150950.25+265104.7	NSV 6969	J171708.50+083929.5	V740 Oph
J151846.68+304945.0	NSV 20296	J171734.05+163531.5	V621 Her
J152704.83+294205.9	NSV 20314	J171806.51+090802.1	NSV 8484
J160126.57+300221.7	NSV 7397	J171830.15+092245.3	NSV 8495
J161021.28+250325.9	NSV 7509	J171839.51+281228.3	KQ Her
J161139.19+250101.0	V681 Her	J171843.60+130622.3	NSV 8503
J161406.62+235315.4	V538 Her	J172022.29+143040.6	DL Her
J162406.76+363548.7	SV CrB	J172119.20+083726.6	NSV 8555
J162558.43+174246.7	V695 Her	J172119.36+095439.1	V750 Oph
J162908.11+341344.2	HT Her	J172308.33+223931.4	V397 Her
J162931.15+182944.5	V698 Her	J172502.43+103818.5	NSV 8622
J163630.25+263213.0	V599 Her	J172530.05+214452.0	V485 Her
J163738.34+083721.6	NSV 7865	J172638.42+265616.5	V486 Her
J163906.52+094756.2	NSV 7883	J172725.98+084314.5	NSV 8773
J163945.40+091637.2	NSV 7891	J172812.34+102626.2	V2074 Oph
J164121.67+122501.7	V546 Her	J172836.76+153115.0	V658 Her
J164409.33+251503.7	AH Her	J172907.86+184239.8	FP Her
J164409.43+341225.7	V450 Her	J173011.66+142233.5	V552 Her
J165020.37+095652.2	LT Her	J173016.44+233719.0	V493 Her
J165124.98+081853.8	NSV 8001	J173137.58+122524.7	V769 Oph
J165319.42+330958.3	KO Her	J173200.87+450142.4	V495 Her
J165505.96+113304.1	V1125 Oph	J173205.53+394531.1	V421 Her
J170207.62+341251.2	IN Her	J173219.79+374414.3	FQ Her
J170236.60+255134.1	V452 Her	J173254.71+111831.1	V776 Oph
J170412.89+262019.6	V454 Her	J173426.95+321331.1	NSV 9188
J170539.90+213100.5	V365 Her	J173640.43+231812.0	V503 Her
J170548.92+333517.6	V646 Her	J173903.05+384138.2	NSV 9450
J170621.17+315318.2	V619 Her	J173903.25+384135.6	NSV 9450
J170641.03+154032.3	NSV 8208	J174056.11+240252.8	V514 Her
J170711.85+361809.4	NSV 8224	J174318.65+281514.6	LX Her
J170717.77+130553.7	NSV 8217	J174413.83+251453.9	FS Her

Table 1: (cont.)

ROTSE1	GCVS	ROTSE1	GCVS
J174556.16+325133.2	EH Her	J183615.60+242928.9	CI Her
J174702.36+453941.9	NSV 9702	J183652.99+280417.6	CE Lyr
J174706.93+383253.6	NSV 9697	J183751.21+472324.5	NSV 11154
J174753.92+264121.3	BK Her	J183856.81+235824.4	CL Her
J174820.33+244227.7	EI Her	J183950.26+385856.2	NSV 11194
J175148.02+263845.2	EL Her	J184023.50+435622.4	V480 Lyr
J175201.83+294008.1	EM Her	J184257.98+451819.5	NSV 11272
J175245.38+353921.5	NSV 9817	J184301.01+321951.3	CQ Lyr
J175338.23+263922.9	EN Her	J184413.82+231230.0	DW Her
J175355.81+281326.0	EO Her	J184506.17+401112.2	NSV 11321
J175510.34+263618.2	EP Her	J184717.62+535644.0	BZ Dra
J175648.63+255417.7	ER Her	J184741.41+383826.6	NSV 11363
J175809.11+411945.0	V526 Her	J184813.35+401846.0	NSV 11371
J175809.27+412537.6	FV Her	J185126.14+461702.4	NSV 11453
J180012.86+343851.1	OS Her	J185231.15+413312.1	NSV 11476
J180350.26+332303.1	EW Her	J185304.14+515837.4	CC Dra
J180438.84+324141.5	EY Her	J185325.94+430918.7	V355 Lyr
J180442.64+232238.9	FX Her	J185410.14+324957.4	RX Lyr
J180507.69+300538.9	FF Her	J185507.82+350119.4	NO Lyr
J180733.25+401530.1	PQ Her	J185546.43+401056.6	NSV 11565
J180955.10+312147.2	FI Her	J185805.21+540853.3	EG Dra
J181258.35+420345.7	V442 Her	J185950.87+452145.9	V396 Lyr
J181339.13+372834.2	V676 Her	J190048.09+500530.0	AW Dra
J181625.83+462753.7	HI Lyr	J190234.05+255026.2	BL Lyr
J181700.08+344856.0	HX Lyr	J190350.47+460144.8	NSV 11717
J182109.33+460854.1	MX Lyr	J190359.49+491641.4	XX Dra
J182109.56+460900.3	MX Lyr	J190402.42+271629.8	BM Lyr
J182240.62+293115.0	NSV 10725	J190725.76+354627.1	V496 Lyr
J182529.14+313304.1	IS Lyr	J190827.56+384842.2	NR Lyr
J182559.91+312952.2	IT Lyr	J190932.16+422013.6	NSV 11780
J182809.21+272403.7	NSV 10876	J191159.94+435725.7	NSV 11820
J182855.38+321513.8	IX Lyr	J191957.87+465320.6	NSV 11924
J182905.77+335457.3	V443 Lyr	J192219.06+441508.9	NSV 11964
J183044.56+382355.1	KN Lyr	J192544.43+510929.2	V1119 Cyg
J183253.85+430101.5	OP Lyr	J192633.96+522908.9	NSV 12055
J183345.31+281716.4	FR Lyr	J193037.82+494040.5	NSV 12114
J183412.62+323533.4	KZ Lyr	J193247.37+430701.5	V461 Cyg
J183412.88+323540.2	KZ Lyr	J193327.66+383202.4	HO Cyg
J183507.95+313233.4	V464 Lyr	J193328.41+403035.4	HP Cyg
J183510.04+423333.8	NSV 11081	J193417.93+425513.0	V1133 Cyg
J183534.10+260357.7	BN Her	J193425.54+451829.5	V1621 Cyg
J183536.41+392944.1	LM Lyr	J193650.52+532833.5	DE Cyg

Table 2: Number of variables in the ROTSE1 survey according to their classification by the ROTSE1 team

ROTSE1 classification	Previously unknown	Identified in Simbad	Identified in this paper	Percentage new variables
c	187	2	12	93
ds	87	3	1	96
e	80	25	4	73
ew	350	29	3	92
lpv	427	47	60	80
m	39	60	47	27
rrab	76	71	39	41
rrc	102	7	4	90

References:

Akerlof, C., Amrose, S., Balsano, R., Bloch, J., Casperson, D., Fletcher, S., Gisler, G., Hills, J., Kehoe, R., Lee, B., Marshall, S., McKay, T., Pawl, A., Schaefer, J., Szymanski, J., Wren, J., 2000, *AJ*, **119**, 1901

Diethelm, R., 2001, *IBVS*, No. 5060

Kinnunen, T., Skiff, B.A., 2000a, *IBVS*, No. 4895

Kinnunen, T., Skiff, B.A., 2000b, *IBVS*, No. 4897

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THE 76TH NAME-LIST OF VARIABLE STARS

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The present 76th Name-List of Variable Stars, compiled basically in the manner first introduced in the 67th Name-List (IBVS No. 2681, 1985), contains all data necessary for identification of 1406 new variables finally designated in 2001. The total number of designated variable stars, not counting designated non-existing stars or stars subsequently identified with earlier-designated variables, has now reached 37391.

The 76th Name-List consists of two tables and a list of references. Table 1 contains the list of new variables arranged in the order of their right ascensions. We start the new century with the new equinox accepted for the GCVS data, 2000.0. The table gives the ordinal number and the designation of each variable; its equatorial coordinates for the equinox 2000.0 (we present right ascensions to $0\overset{s}{.}1$ and declinations to $1''$. The coordinates were found in the literature, taken from positional catalogues, including USNO A1.0/A2.0 and GSC, or determined by the authors); the range of variability (sometimes the column "Min" gives, in parentheses, the amplitude of light variation; the symbol "(" means that the star, in minimum light, becomes fainter, than the magnitude indicated); and the system of magnitudes used ("P" are photographic magnitudes; the symbols "Rc", "Ic" designate magnitudes in Cousins's *RI* system; the symbols "b", "y" mean Strömgren's *b*, *y* magnitudes; "g, i" are magnitudes in Gunn's system; "Hp" stands for magnitudes in the system of the Hipparcos Catalog; "*" corresponds to unfiltered CCD magnitudes; the rest of designations are standard Johnson *UBVRIJK* magnitudes); the type of variability according to the classification system described in the forewords to the first three volumes of the 4th GCVS edition (with the additions introduced in the 68th Name-List, IBVS No. 3058, 1987, in the 69th Name-List, IBVS No. 3323, 1989, in the 72nd Name-List, IBVS No. 4140, in the 75th Name-List, IBVS No. 4870, and two additions described below; see also the description of variability types and distribution of stars over variability types at `http://www.sai.msu.su/groups/cluster/gcvs/gcvs/iii/vartype.txt`); two references to the list of papers which follows Table 2 (the first reference is to the investigation of the star, the second one indicates the paper containing a finding chart, or refers to the Durchmusterung – DM (BD, CoD, or CPD), or the Hubble Space Telescope Guide Star Catalog – GSC, or the USNO A1.0/A2.0 catalog – USNO, if the star can be found using one of them).

The order of stars in Table 1 corresponds to the order of their 2000.0 right ascension. Note that several stars named between Name-Lists No. 75 and No. 76 upon request from the IAU Bureau of Astronomical Telegrams have GCVS names, within their constellation, not in their proper order by right ascension.

We have decided to indicate the system of magnitudes as "V" for numerous stars studied by Japanese amateur astronomers using photographs on T400 films, though the authors call their system "photographic". These films, together with the magnitudes of comparison stars use, reproduce a system resembling the traditional photovisual one, and at least a system far for the traditional photographic one. The designation "*", besides unfiltered CCD data, was also used for the photoelectric magnitudes in the non-standard Wroclaw V_W system.

In a small number of cases, the value of the variability amplitude (column "Min", in parentheses) could not be expressed in the same system of magnitudes as the star's brightness; in such cases we indicate the photometric band for the amplitude separately.

In the present Name-List, we have introduced two new variability types for variable stars. The prototypes are the stars of the present Name-List.

EP. Stars showing eclipses by their planets. Prototype: V376 Peg.

SRS. Semiregular pulsating red giants with short period (several days to a month), probably high-overtone pulsators. Prototype: AU Ari.

A version of Table 1 given in the electronic supplement to this paper (file 5135-t1.txt) contains also coordinates for the equinox 1950.0. In the electronic table, no spaces are left between hours and minutes, minutes and seconds of right ascension or between degrees and minutes, minutes and seconds of declination.

Table 2 contains the list of variables arranged in the order of their variable star names within constellations. After the designation of a variable, its ordinal number from Table 1 is given, as well as identifications with several major catalogues and identifications necessary to find this star in the papers referred to in Table 1 or in the papers with the first (or independent) announcement of the discovery of its variability, referred to (in some cases) in square brackets after the corresponding identification in Table 2. In variance with our earlier practice and in accordance with the style of Name-List No. 75, we did not include names of discoverers different from the name of the author(s) of the paper referred to. After the identifications, some minimal remarks are given if necessary. Table 2 and the list of references are also presented in the form of ASCII files in the electronic supplement to this paper (files 5135-t2.txt and 5135-t3.txt). The abbreviated names of the catalogues in Table 2 generally follow conventions of the GCVS or of the SIMBAD data base; in its electronic version, "Name" stands for non-standard names or abbreviations, mainly from discovery announcements, and "Rmrk", for remarks.

We would like to introduce a correction to the Name-List No. 73 (IBVS No. 4471, 1997). For the star No. 73113 (V1099 Tau), the magnitude in the column "Max" should be 6.31.

As usual, those wishing to find new and corrected GCVS and NSV catalog information are asked to regularly visit our web site:

`http://www.sai.msu.su/groups/cluster/gcvs/gcvs/`

At our web site, we will soon open access to a new table, containing accurate coordinates and, whenever available, proper motions for many GCVS and NSV catalog stars, taken from positional catalogs (referred to on the list) or measured by the GCVS team. The list will be continuously expanded in the course of our future positional work. The positional information is based upon our new identifications, primarily using the best finding charts available, and checked by comparison with identifications by other authors whenever possible.

Thanks are due to Dr. S.V. Antipin for his help during the preparation of the present Name-List and to all members of the GCVS team who prepared information for the variable star data base. We would like to thank many scientists who immediately responsed to our requests to provide missing data or correct erroneous data necessary for this Name-List. Also, thanks are due for sending us corrections to our catalogs and Name-Lists. This study was supported in part by Russian Foundation for Basic Research through grant 99-02-16333, by the Russian Federal Scientific and Technological Programme "Astronomy", and by the Support Programme for Leading Scientific Schools of Russia.

Table 1

No.	Name		R.A.,Decl., 2000.0		Max	Min		Type	Ref.	
			h m s	o ’ "	m	m				
760001	DU	Psc	00 01 38.7	-03 45 24	9.5	10.57	I	SR	001	GSC
760002	V855	Cas	00 05 29.3	+52 52 58	12.6	(16.0	V	M	002	002
760003	V856	Cas	00 06 42.7	+52 27 33	12.5	14.8	V	SR	002	002
760004	V414	And	00 09 36.9	+37 47 32	12.4	15.5	V	M	002	002
760005	V857	Cas	00 09 39.8	+53 10 11	12.5	(15.2	V	M	002	002
760006	DV	Psc	00 13 09.2	+05 35 43	10.59	(0.51Rc)	V	E/RS	003	003
760007	V858	Cas	00 19 10.7	+52 02 03	13.0	15.3	V	SR	002	002
760008	V859	Cas	00 21 20.7	+51 21 39	10.5	15.5	V	M	002	002
760009	CM	Phe	00 21 33.2	-51 42 36	15.28	(0.5)	V	E:+NL	004	005
760010	V860	Cas	00 26 49.0	+49 40 36	12.4	13.8	V	EA	002	002
760011	V861	Cas	00 36 36.7	+68 01 20	7.5	10.8	I	M	006	006
760012	V862	Cas	00 38 40.2	+53 16 11	11.0	(16.0	V	M	002	002
760013	V863	Cas	00 43 28.4	+64 45 35	10.54	(0.09)	V	WR	007	008
760014	V864	Cas	00 45 01.1	+48 41 04	10.7	13.1	V	SRA	002	002
760015	CN	Phe	00 46 37.6	-42 09 37	9.45	(0.01)	V	DSCTC	009	DM
760016	V865	Cas	00 49 07.0	+68 05 47	9.7	11.6	I	M	006	011
760017	V866	Cas	00 49 37.9	+50 56 42	11.7	12.9	V	SR:	012	GSC
760018	V415	And	00 50 43.3	+46 30 31	13.0	(16.0	V	SRB	002	002
760019	CO	Phe	00 52 00.6	-47 07 09	16.53	(0.15)	V	ZZA	013	010
760020	V867	Cas	00 56 28.5	+60 47 10	8.8	11.8	I	M	006	011
760021	V416	And	01 10 30.5	+45 06 12	11.7	(14.7	V	M	002	002
760022	V417	And	01 16 04.7	+50 11 45	11.1	14.7	V	M	002	002
760023	EQ	Cet	01 28 52.5	-23 39 43	16.1	16.7	i	XM	014	014
760024	V418	And	01 30 05.8	+50 10 01	11.3	14.4	V	M	002	002
760025	DW	Psc	01 30 26.9	+08 41 34	13.66	14.41	V	SXPHE	015	GSC
760026	CV	Hyi	01 32 42.0	-65 54 32	20.	(2.2 *)	V	XM	016	016
760027	ER	Cet	01 34 06.6	-10 14 03	11.7	15.2	V	M:	012	GSC
760028	V868	Cas	01 46 38.0	+61 08 44	15.5	(0.14I)	B	EA:	017	017
760029	V869	Cas	01 46 50.3	+61 06 47	16.4	(0.55I)	B	E:	017	017
760030	AU	Ari	02 08 56.7	+17 34 46	8.45	8.69	Hp	SRS	018	DM
760031	V419	And	02 09 02.3	+39 35 32	9.14	(0.04)	B	DSCTC	019	DM
760032	AV	Ari	02 10 37.6	+19 30 01	5.68	5.76	Hp	SRS	018	DM
760033	V420	And	02 18 21.3	+50 46 03	11.2	(14.8	V	M	020	020
760034	V611	Per	02 18 29.8	+57 09 03	9.35	(0.04)	V	BCEP	021	021
760035	V612	Per	02 18 51.1	+57 08 36	11.94	(0.14)	V	LBV	021	021
760036	V613	Per	02 18 53.9	+57 08 22	9.50	(0.01)	V	BE	021	021
760037	V614	Per	02 19 00.1	+57 08 44	9.90	(0.02)	V	BCEP	021	021
760038	V615	Per	02 19 01.7	+57 07 19	12.98	13.40	V	EA	021	021
760039	V616	Per	02 19 04.2	+57 09 43	16.4	(0.9)	V	EW	021	021
760040	V617	Per	02 19 06.7	+57 08 53	11.13	(0.02)	V	ELL:	021	021
760041	V618	Per	02 19 11.7	+57 06 40	14.60	15.13	V	EA	021	021
760042	V619	Per	02 22 02.8	+57 08 26	10.0	(0.04)	B	BCEP	022	022
760043	V620	Per	02 22 09.0	+57 07 26	12.0	(0.28)	B	EA	022	022
760044	V621	Per	02 22 09.7	+57 07 02	9.5	(0.12)	B	EA	022	022
760045	V622	Per	02 22 17.6	+57 07 25	9.3	(0.05)	B	ELL:	022	022
760046	V421	And	02 23 20.9	+48 43 42	10.1	(12.	V	M	023	023

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s	° ' "	Max m	Min m		Type	Ref.
760047	V623	Per	02 41 50.8	+42 51 38	11.48	(0.03)	V	GDOR:	024 025
760048	V624	Per	02 42 34.5	+42 44 51	11.50	(0.03)	V	GDOR:	024 025
760049	HX	Eri	03 05 17.6	−18 38 10	12.60	(0.6)	V	EA	012 GSC
760050	V625	Per	03 21 06.5	+48 26 14	12.80	(0.09)	V	BY	026 GSC
760051	V626	Per	03 21 22.2	+49 57 04	13.89	(0.24)	V	BY	026 GSC
760052	V627	Per	03 26 22.6	+47 16 10	11.89	(0.08)	V	RS:	026 GSC
760053	V628	Per	03 26 25.3	+48 20 07	12.03	(0.07)	V	BY	026 GSC
760054	V629	Per	03 27 20.3	+47 59 26	13.40	(0.22)	V	BY	026 GSC
760055	V630	Per	03 28 22.5	+49 14 30	12.78	(0.13)	V	BY	026 GSC
760056	V631	Per	03 28 23.7	+47 36 51	13.28	(0.08)	V	BY	026 GSC
760057	HX	Cam	03 31 00.2	+60 47 40	12.7	13.2	V	SR:	012 GSC
760058	HY	Cam	03 32 56.5	+53 58 47	13.1	13.8	V	SR:	012 GSC
760059	HZ	Cam	03 36 41.4	+53 28 37	11.1	11.6	V	SR:	012 GSC
760060	V1185	Tau	03 39 00.6	+29 41 46	10.74	10.88	V	IA	027 GSC
760061	II	Cam	03 40 15.6	+68 54 35	11.8	12.4	V	SR:	012 GSC
760062	V632	Per	03 40 23.2	+40 45 36	11.1	12.6	V	SR:	012 GSC
760063	IK	Cam	03 41 03.9	+67 38 52	14.1	(15.1	V	M:	012 GSC
760064	V633	Per	03 42 10.9	+32 08 17	13.0	13.5	V	SR:	012 GSC
760065	V1186	Tau	03 42 26.8	+24 50 21	17.42	(0.10)	Ic	BY	028 029
760066	IL	Cam	03 43 53.0	+67 40 52	12.7	(15.1	V	M	012 USNO
760067	V1187	Tau	03 44 00.3	+24 33 25	8.28	(0.02)	B	DSCTC	009 DM
760068	V634	Per	03 45 24.5	+40 53 48	10.3	11.5	V	SR:	012 GSC
760069	V1188	Tau	03 45 36.0	+24 30 01	11.85	12.30	V	EW	030 030
760070	V635	Per	03 46 05.1	+38 22 12	12.7	14.9	V	SR:	012 GSC
760071	V1189	Tau	03 46 12.9	+24 03 17	14.08	(0.14)	V	BY	031 032
760072	V1190	Tau	03 47 33.8	+29 58 51	12.4	13.8	V	SR:	012 GSC
760073	V636	Per	03 48 45.5	+42 55 41	11.7	12.6	V	SR:	012 GSC
760074	V1191	Tau	03 49 27.6	+06 04 40	11.1	(15.3	V	M	012 GSC
760075	V1192	Tau	03 50 28.1	+27 40 06	11.5	12.5	V	SR:	012 GSC
760076	V1193	Tau	03 51 12.1	+23 55 58	14.74	(0.07)	V	BY	031 032
760077	V637	Per	03 54 02.3	+36 32 18	12.1	12.6	V	SR:	012 GSC
760078	V638	Per	03 57 21.3	+40 02 45	13.6	(14.6	V	M:	012
760079	V1194	Tau	04 03 25.0	+17 24 26	11.65	11.80	V	IT	033 GSC
760080	IM	Cam	04 03 29.5	+53 14 19	13.0	13.5	V	SR:	012 GSC
760081	V639	Per	04 03 33.5	+49 45 49	13.4	14.1	V	SR:	012 GSC
760082	V640	Per	04 03 53.7	+51 01 06	13.1	13.7	V	SR:	012 GSC
760083	V641	Per	04 04 34.0	+46 36 40	13.0	13.9	V	SR:	012 GSC
760084	V642	Per	04 06 16.7	+47 45 38	13.1	13.8	V	SR:	012 GSC
760085	V1195	Tau	04 06 51.3	+25 41 29	11.68	(0.21)	V	IT	033 GSC
760086	V1196	Tau	04 08 13.0	+19 56 39	12.95	13.35	V	E:	033 GSC
760087	V1197	Tau	04 09 09.8	+29 01 30	10.55	10.62	V	IT	033 GSC
760088	V643	Per	04 09 11.9	+36 25 39	7.68	7.80	Hp	SRS	018 DM
760089	IN	Cam	04 12 18.2	+54 02 08	13.3	13.9	V	SR:	012 GSC
760090	V1198	Tau	04 12 51.2	+24 41 44	11.93	12.01	V	IT	033 GSC
760091	V644	Per	04 14 13.8	+43 54 52	12.1	13.2	V	SR:	012 GSC
760092	V645	Per	04 14 45.8	+43 46 27	11.6	12.1	V	SR:	012 GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0	Max	Min		Type	Ref.
			h m s o ' "	m	m			
760093	V1199	Tau	04 15 22.9 +20 44 17	10.60	10.72	V	IT	033 GSC
760094	V646	Per	04 15 37.7 +35 12 26	10.8	12.2	V	SR:	012 GSC
760095	V647	Per	04 16 07.8 +41 39 35	11.4	12.7	V	SR:	012 GSC
760096	V648	Per	04 17 29.7 +35 18 16	13.0	14.0	V	SR:	012 GSC
760097	V649	Per	04 18 08.3 +45 16 52	12.2	13.0	V	SR:	012 034
760098	V650	Per	04 18 16.7 +44 53 58	12.4	13.0	V	SR:	012 GSC
760099	V651	Per	04 20 11.4 +33 17 26	12.0	12.8	V	SR:	012 GSC
760100	V652	Per	04 20 24.1 +31 23 24	12.33	(0.07)	V	IT	033 GSC
760101	V653	Per	04 21 25.6 +41 52 18	12.7	(15.0	V	M:	012
760102	IO	Cam	04 22 18.5 +56 35 38	12.1	12.7	V	SR:	258 GSC
760103	V654	Per	04 23 14.8 +49 12 34	13.0	13.7	V	SR:	012 GSC
760104	V1200	Tau	04 23 41.3 +15 37 55	11.17	11.33	V	IT	033 GSC
760105	V655	Per	04 24 31.9 +48 03 12	12.9	14.1	V	SR:	012 GSC
760106	V1201	Tau	04 24 49.0 +26 43 10	11.31	(0.16)	V	IT	033 GSC
760107	IP	Cam	04 25 48.0 +52 56 48	12.3	12.8	V	SR:	012 GSC
760108	IQ	Cam	04 26 06.9 +54 28 18	14.48	14.63	Rc	E	035 036
760109	V656	Per	04 27 34.4 +51 21 06	11.3	11.9	V	SR:	012 GSC
760110	IR	Cam	04 29 42.7 +58 37 39	12.7	13.3	V	SR:	012 GSC
760111	V1202	Tau	04 31 16.9 +21 50 25	10.79	10.92	V	IT	033 GSC
760112	V1203	Tau	04 32 42.4 +18 55 10	10.74	10.85	V	IT	033 GSC
760113	IS	Cam	04 32 58.5 +63 21 44	13.7	14.3	V	SR:	012 GSC
760114	IT	Cam	04 34 11.0 +57 33 34	12.1	12.8	V	LB	012 GSC
760115	V657	Per	04 37 39.1 +32 37 27	11.7	12.7	V	SR:	012 GSC
760116	V1204	Tau	04 38 39.1 +15 46 14	10.64	10.84	V	IT	033 GSC
760117	IU	Cam	04 39 16.9 +65 47 57	11.8	12.4	V	SR:	012 GSC
760118	V1205	Tau	04 44 23.5 +20 17 17	12.53	12.70	V	IT	033 GSC
760119	V1405	Ori	04 44 56.9 +14 21 51	15.11	(0.10)	V	RPHS	037 038
760120	V1206	Tau	04 45 51.3 +15 55 50	9.18	9.41	V	IT	033 GSC
760121	V497	Aur	04 52 33.5 +45 41 37	11.6	13.2	V	SR:	012 GSC
760122	V498	Aur	04 55 26.9 +29 15 11	11.5	12.2	V	SR:	012 GSC
760123	V499	Aur	04 55 54.7 +36 48 25	12.3	12.8	V	SR:	012 GSC
760124	V500	Aur	04 56 27.4 +33 03 50	12.6	13.2	V	SR:	012 GSC
760125	V1406	Ori	04 57 00.6 +15 17 53	10.24	10.34	V	IT	033 GSC
760126	V501	Aur	04 57 06.5 +31 42 50	10.59	10.83	V	IT:	033 GSC
760127	V1407	Ori	04 57 17.7 +15 25 09	10.22	10.38	V	IT	033 GSC
760128	V1207	Tau	04 58 39.7 +20 46 43	11.86	11.96	V	IT	033 GSC
760129	V1208	Tau	04 59 44.0 +19 26 23	15.	18.	V	UGSU	039 005
760130	HY	Eri	05 01 45.6 -03 59 37	17.4	22.7	V	XM+EA	040 005
760131	IV	Cam	05 04 22.2 +67 47 48	11.4	12.4	V	SR:	012 GSC
760132	V502	Aur	05 04 23.5 +37 58 11	11.0	12.0	V	SR:	012 GSC
760133	IW	Cam	05 08 42.5 +66 16 01	12.5	(14.7	V	M	012 USNO
760134	IX	Cam	05 10 46.2 +62 14 03	13.4	14.1	V	SR:	012 GSC
760135	V503	Aur	05 10 55.3 +33 18 07	12.2	13.3	V	SR:	012 GSC
760136	IY	Cam	05 14 38.4 +64 06 22	12.9	14.0	V	SR:	012 GSC
760137	V1408	Ori	05 14 52.1 +10 11 07	11.74	12.14	*	SR	041 GSC
760138	IZ	Cam	05 17 50.9 +64 52 08	11.9	12.6	V	SR:	012 GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s o ' "	Max m	Min m		Type	Ref.	
760139	KK	Cam	05 19 46.1 +64 26 02	12.0	(14.5	V	M	012	GSC
760140	AD	Lep	05 21 44.6 -15 55 34	12.3	15.3	V	M	012	GSC
760141	KL	Cam	05 22 43.7 +64 19 08	10.8	12.9	V	SR:	012	GSC
760142	AQ	Col	05 23 25.5 -39 11 55	15.55	(0.10)	V	RPHS	037	GSC
760143	V504	Aur	05 25 59.7 +45 12 19	11.8	12.6	V	SR:	012	GSC
760144	V505	Aur	05 27 36.3 +48 42 23	10.5	11.3	V	SR	042	042
760145	V1409	Ori	05 30 19.0 +11 20 20	10.12	10.24	V	INA	027	DM
760146	V506	Aur	05 30 42.4 +42 50 20	12.8	13.7	V	SR:	012	GSC
760147	V1410	Ori	05 31 57.3 +11 17 41	9.48	9.73	V	INA	027	DM
760148	AF	Pic	05 33 05.8 -56 02 28	16.00	(0.2)	V	ZZA	043	USNO
760149	V1411	Ori	05 33 51.9 -05 54 26	14.0	(0.10)	I	IN	044	USNO
760150	V1412	Ori	05 33 53.3 -04 56 05	14.2	(0.15)	I	IN	044	USNO
760151	V1413	Ori	05 33 54.6 -06 02 09	13.3	(0.15)	I	IN	044	USNO
760152	V1414	Ori	05 33 57.7 -05 40 05	13.7	(0.17)	I	IN	044	
760153	V1415	Ori	05 33 57.9 -05 36 27	14.6	(0.14)	I	IN	044	USNO
760154	KM	Cam	05 33 59.2 +57 53 38	13.2	14.0	V	SR:	012	GSC
760155	V1416	Ori	05 34 01.1 -06 02 27	13.3	(0.14)	I	IN	044	USNO
760156	V1417	Ori	05 34 01.7 -05 46 51	13.7	(0.17)	I	IN	044	USNO
760157	V1418	Ori	05 34 02.5 -06 04 31	15.9	(0.65)	I	IN	044	USNO
760158	V1419	Ori	05 34 02.9 -05 49 44	13.9	(0.17)	I	IN	044	USNO
760159	V1420	Ori	05 34 03.6 -05 22 19	14.0	(0.10)	I	IN	044	
760160	V1421	Ori	05 34 08.9 -05 24 05	14.0	(0.19)	I	IN	044	
760161	V1422	Ori	05 34 12.3 -05 41 35	15.7	(0.14)	I	IN	044	
760162	V1423	Ori	05 34 13.0 -05 42 13	13.8	(0.12)	I	IN	044	USNO
760163	V1424	Ori	05 34 14.1 -05 47 21	14.6	(0.17)	I	IN	044	USNO
760164	V1425	Ori	05 34 14.2 -05 42 21	13.8	(0.21)	I	IN	044	045
760165	V1426	Ori	05 34 17.6 -06 03 38	13.8	(0.13)	I	IN	044	USNO
760166	V1427	Ori	05 34 17.9 -05 33 33	12.9	(0.12)	I	INB	044	046
760167	V1428	Ori	05 34 21.5 -04 55 48	14.6	(0.32)	I	IN	044	USNO
760168	V1429	Ori	05 34 26.1 -05 07 33	14.5	(0.20)	I	IN	044	USNO
760169	V1430	Ori	05 34 27.8 -05 42 10	14.2	(0.13)	I	IN	044	USNO
760170	V1431	Ori	05 34 28.9 -05 14 15	13.0	(0.22)	I	INB	044	047
760171	V1432	Ori	05 34 29.3 -05 14 40	12.7	(0.29)	I	INB	044	047
760172	V1433	Ori	05 34 29.9 -05 04 05	14.2	(0.14)	I	IN	044	USNO
760173	V1434	Ori	05 34 30.2 -04 58 30	13.9	(0.11)	I	IN	044	046
760174	V1435	Ori	05 34 31.1 -05 21 56	14.0	(0.18)	I	INB	044	047
760175	V1436	Ori	05 34 33.0 -05 57 47	14.0	(0.16)	I	IN	044	USNO
760176	V1437	Ori	05 34 36.1 -05 42 15	13.2	(0.18)	I	IN	044	USNO
760177	V1438	Ori	05 34 38.0 -05 27 41	14.2	(0.18)	I	INB	044	047
760178	V1439	Ori	05 34 40.1 -04 58 40	12.7	(0.13)	I	IN	044	046
760179	V1440	Ori	05 34 42.7 -04 42 15	13.1	(0.30)	I	IN	044	046
760180	V1441	Ori	05 34 42.9 -05 20 08	12.7	(0.13)	I	INB	044	047
760181	V1442	Ori	05 34 44.4 -05 56 15	14.5	(0.25)	I	IN	044	USNO
760182	V1443	Ori	05 34 44.5 -04 42 14	12.3	(0.15)	I	IN	044	046
760183	V1444	Ori	05 34 45.1 -05 25 04	11.4	(0.3)	I	INB	048	047
760184	V1445	Ori	05 34 45.5 -05 29 21	13.8	(0.07)	I	INB	048	047

Table 1 (continued)

No.	Name	R.A.,Decl., 2000.0 h m s	o ’ "	Max m	Min m		Type	Ref.
760185	V1446 Ori	05 34 45.9	-05 24 56	13.7	(0.25)	I	INB	044 047
760186	V1447 Ori	05 34 45.9	-05 41 10	14.2	(0.13)	I	IN	044 USNO
760187	V1448 Ori	05 34 45.9	-04 49 22	15.4	(0.65)	I	IN	044 046
760188	V1449 Ori	05 34 46.5	-05 23 26	14.6	(0.2)	I	INB	048 047
760189	V1450 Ori	05 34 48.3	-05 37 23	12.8	(0.20)	I	INB	044 047
760190	V1451 Ori	05 34 48.4	-05 05 01	13.7	(0.15)	I	IN	044 046
760191	V1452 Ori	05 34 48.9	-04 57 14	15.2	(0.12)	I	IN	044 USNO
760192	V1453 Ori	05 34 49.7	+10 16 11	12.06	12.25	*	SR	049 GSC
760193	V1454 Ori	05 34 50.7	-05 24 01	12.5	(0.15)	I	INB	048 047
760194	V1455 Ori	05 34 50.8	-05 29 25	14.3	(0.09)	I	INB	044 047
760195	V1456 Ori	05 34 51.4	-05 00 11	14.7	(0.13)	I	IN	044 USNO
760196	V1457 Ori	05 34 51.7	-05 39 23	13.7	(0.15)	I	IN	044
760197	V1458 Ori	05 34 52.1	-05 22 32	12.6	(0.15)	I	INB	044 047
760198	V1459 Ori	05 34 52.6	-05 24 04	13.3	(0.06)	I	INB	048 047
760199	V1460 Ori	05 34 52.6	-05 29 45	13.9	(0.1)	I	INB	048 047
760200	V1461 Ori	05 34 52.9	-05 28 59	14.7	(0.21)	I	INB	044 047
760201	V1462 Ori	05 34 53.9	-05 27 49	15.8	(0.20)	I	INB	044 047
760202	V1463 Ori	05 34 54.2	-05 28 54	15.2	(0.25)	I	INB	044 047
760203	V1464 Ori	05 34 54.6	-05 28 18	15.3	(0.45)	I	INB	044 047
760204	V1465 Ori	05 34 55.4	-05 01 39	13.7	(0.15)	I	IN	044 046
760205	V1466 Ori	05 34 55.9	-05 31 13	13.87	17.95	Ic	INB	050 047
760206	V1467 Ori	05 34 56.3	-06 04 17	13.8	(0.14)	I	IN	044 USNO
760207	V1468 Ori	05 34 56.6	-05 52 07	14.3	(0.30)	I	IN	044 USNO
760208	V1469 Ori	05 34 56.9	-05 22 06	16.2	(1.5)	I	IN	044 047
760209	V1470 Ori	05 34 57.0	-05 23 00	14.9	(0.16)	I	INB	044 047
760210	V1471 Ori	05 34 57.2	-05 42 03	14.1	(0.18)	I	IN	044 USNO
760211	V1472 Ori	05 34 57.8	-05 49 13	14.3	(0.12)	I	IN	044
760212	V1473 Ori	05 34 57.9	-05 29 46	15.1	(0.12)	I	INB	044 047
760213	V1474 Ori	05 34 58.5	-05 32 50	16.0	(0.17)	I	INB	044 047
760214	V1475 Ori	05 34 58.9	-05 28 03	14.2	(0.09)	I	INB	044 047
760215	V1476 Ori	05 34 59.3	-05 05 30	14.1	(0.22)	I	IN	044 USNO
760216	V1477 Ori	05 34 59.6	-05 25 40	13.6	(0.27)	I	INB	044 047
760217	V1478 Ori	05 35 00.2	-05 18 51	14.3	(0.20)	I	INB	044 047
760218	V1479 Ori	05 35 01.5	-05 28 21	14.0	(0.14)	I	INB	044 047
760219	V1480 Ori	05 35 02.0	-05 15 37	14.0	(0.32)	I	INB	044
760220	V1481 Ori	05 35 03.9	-05 29 03	12.8	(0.28)	I	INB	044 047
760221	V1482 Ori	05 35 04.0	-05 26 37	13.6	(0.14)	I	INB	044 047
760222	V1483 Ori	05 35 04.5	-05 26 04	13.9	(0.1)	I	INB	048 047
760223	V1484 Ori	05 35 05.7	-05 26 26	13.4	(0.11)	I	INB	044 047
760224	V1485 Ori	05 35 08.0	-05 36 47	14.9	(0.13)	I	INB	048 047
760225	V1486 Ori	05 35 09.1	-05 30 58	16.3	(0.20)	I	IN	044
760226	V1487 Ori	05 35 10.5	-05 22 46	12.38	(0.19)	Ic	INB	051 047
760227	V1488 Ori	05 35 11.1	-05 34 60	13.9	(0.08)	I	INB	048 047
760228	V1489 Ori	05 35 11.2	-05 41 36	16.2	(0.23)	I	IN	044
760229	V1490 Ori	05 35 11.9	-05 45 38	13.3	(0.35)	I	IN	044 046
760230	V1491 Ori	05 35 12.6	-04 51 56	12.9	(0.15)	I	IN	044 046

Table 1 (continued)

No.	Name	R.A.,Decl., 2000.0 h m s o ' "	Max m	Min m		Type	Ref.
760231	V1492 Ori	05 35 12.7 -05 16 14	14.5	(0.14)	I	INB	044 047
760232	V1493 Ori	05 35 13.4 -05 30 48	14.1	(0.13)	I	INB	044 047
760233	V1494 Ori	05 35 13.6 -05 24 26	13.0	(0.4)	I	INB	048 047
760234	V1495 Ori	05 35 13.6 -05 28 46	14.4	(0.40)	I	IN	044 047
760235	V1496 Ori	05 35 13.8 -05 22 07	12.30	(0.59)	Ic	FU:	051 047
760236	V1497 Ori	05 35 14.3 -04 55 22	14.4	(0.28)	I	IN	044 052
760237	V1498 Ori	05 35 14.4 -05 32 47	14.8	(0.16)	I	IN	044 047
760238	V1499 Ori	05 35 14.9 -05 56 37	14.6	(0.21)	I	IN	044 045
760239	V1500 Ori	05 35 14.9 -05 36 40	14.5	(0.32)	I	INB	044 047
760240	V1501 Ori	05 35 15.5 -05 25 14	11.7	(0.25)	I	INB	048 047
760241	V1502 Ori	05 35 15.7 -05 26 28	14.4	(0.7)	I	INB	044 047
760242	V1503 Ori	05 35 15.7 -05 03 26	16.2	(0.24)	I	IN	044
760243	V1504 Ori	05 35 15.7 -05 32 59	13.9	(0.45)	I	IN	048 047
760244	V1505 Ori	05 35 16.2 -05 31 01	15.0	(0.12)	I	INB	044 047
760245	V1506 Ori	05 35 16.5 -05 42 40	12.4	(0.16)	I	IN	044 046
760246	V1507 Ori	05 35 17.1 -05 41 54	14.8	(0.10)	I	IN	044
760247	V1508 Ori	05 35 17.4 -05 09 49	15.2	(0.18)	I	INB	044 047
760248	V1509 Ori	05 35 17.5 -05 17 40	14.5	(0.12)	I	INB	044 047
760249	V1510 Ori	05 35 17.5 -05 22 57	12.35	(1.5)	Ic	INB	048 047
760250	V1511 Ori	05 35 17.9 -05 35 16	14.7	(1.0)	I	INB	044 047
760251	V1512 Ori	05 35 18.0 -05 29 35	13.3	(0.15)	I	INB	048 047
760252	V1513 Ori	05 35 18.2 -05 31 42	16.0	(0.47)	I	IN	044
760253	V1514 Ori	05 35 19.8 -05 30 38	14.3	(0.15)	I	IN	044 047
760254	V1515 Ori	05 35 19.9 -05 33 54	13.6	(0.16)	I	IN	044 047
760255	V1516 Ori	05 35 20.0 -05 25 38	13.2	(0.6)	I	INB	048 047
760256	V1517 Ori	05 35 20.1 -05 21 34	12.9	(0.99)	Ic	INB	051 047
760257	V1518 Ori	05 35 20.3 -05 32 17	15.7	(0.17)	I	INB	044 047
760258	V1519 Ori	05 35 20.4 -05 02 27	14.0	(0.16)	I	IN	044 USNO
760259	V1520 Ori	05 35 20.4 -05 23 30	13.04	(0.40)	Ic	INB	051 047
760260	V1521 Ori	05 35 20.5 -05 20 44	15.2	(1.0)	I	IN	044 047
760261	V1522 Ori	05 35 21.0 -05 28 09	13.9	(0.11)	I	INB	044 047
760262	V1523 Ori	05 35 21.3 -05 26 43	12.1	(0.4)	I	INB	048 047
760263	V1524 Ori	05 35 21.3 -05 23 46	14.16	(1.3)	Ic	IN	048 047
760264	V1525 Ori	05 35 22.0 -05 28 15	14.4	(0.13)	I	IN	048 047
760265	V1526 Ori	05 35 22.3 -05 35 27	14.4	(0.14)	I	INB	044 047
760266	V1527 Ori	05 35 22.5 -05 23 44	13.12	(0.39)	Ic	INB	051 047
760267	V1528 Ori	05 35 22.8 -05 31 37	14.1	(0.25)	I	INB	048 047
760268	V1529 Ori	05 35 22.8 -05 44 43	13.5	(0.12)	I	IN	044 USNO
760269	V1530 Ori	05 35 23.3 -05 28 10	14.8	(0.35)	I	INB	044 047
760270	V1531 Ori	05 35 23.3 -05 18 51	13.1	(0.15)	I	INB	044 047
760271	V1532 Ori	05 35 23.6 -05 52 29	13.9	(0.17)	I	IN	044
760272	V1533 Ori	05 35 25.2 -05 33 21	15.0	(0.20)	I	INB	044 047
760273	V1534 Ori	05 35 25.3 -05 53 21	13.7	(0.23)	I	IN	044
760274	V1535 Ori	05 35 25.4 -05 10 48	12.5	(0.2)	I	INB	044 047
760275	V1536 Ori	05 35 25.6 -04 49 31	14.8	(0.17)	I	IN	044
760276	V1537 Ori	05 35 25.6 -05 30 38	14.4	(0.65)	I	EW:	048 047

Table 1 (continued)

No.	Name	R.A.,Decl., 2000.0 h m s o ' "	Max m	Min m		Type	Ref.
760277	V1538 Ori	05 35 25.7 -05 29 35	16.0	(0.22)	I	INB	044 047
760278	V1539 Ori	05 35 27.5 -05 35 20	12.0	(0.20)	I	INB	044 047
760279	V1540 Ori	05 35 27.5 -05 28 31	13.8	(0.12)	I	INB	048 047
760280	V1541 Ori	05 35 27.7 -05 18 05	15.3	(0.25)	I	INB	044 047
760281	V1542 Ori	05 35 27.8 -05 28 02	13.8	(0.14)	I	INB	048 047
760282	V1543 Ori	05 35 28.1 -05 11 38	15.4	(0.50)	I	INB	044 047
760283	V1544 Ori	05 35 28.2 -05 00 50	14.0	(0.20):	I	IN	044 USNO
760284	V1545 Ori	05 35 28.3 -05 18 23	13.9	(0.12)	I	INB	044 047
760285	V1546 Ori	05 35 28.3 -05 59 13	13.9	(0.14)	I	IN	044 045
760286	V1547 Ori	05 35 28.6 -04 47 27	14.3	(0.17)	I	IN	044 046
760287	V1548 Ori	05 35 28.9 -05 35 07	14.0	(0.2)	I	INB	048 047
760288	V1549 Ori	05 35 29.0 -05 49 50	12.2	(0.16)	I	IN	044 046
760289	V1550 Ori	05 35 29.0 -05 29 11	13.5	(0.6)	I	INB	048 047
760290	V1551 Ori	05 35 29.3 -05 45 38	14.4	(0.12)	I	IN	044 USNO
760291	V1552 Ori	05 35 29.6 -05 31 12	13.7	(0.13)	I	INB	048 047
760292	V1553 Ori	05 35 30.1 -05 51 17	13.2	(0.21)	I	IN	044 046
760293	V1554 Ori	05 35 30.2 -05 25 52	13.7	(0.17)	I	INB	044 047
760294	V1555 Ori	05 35 30.8 -05 30 36	13.9	(0.45)	I	INB	048 047
760295	V1556 Ori	05 35 30.8 -05 43 05	13.3	(0.07)	I	IN	044 046
760296	V1557 Ori	05 35 31.1 -05 12 28	14.3	(0.15)	I	INB	044 047
760297	V1558 Ori	05 35 31.2 -05 40 11	13.4	(0.12)	I	IN	044 046
760298	V1559 Ori	05 35 31.4 -05 28 17	15.0	(0.5)	I	INB	048 047
760299	V1560 Ori	05 35 31.5 -05 40 28	15.4	(0.16)	I	IN	044
760300	V1561 Ori	05 35 31.6 -05 30 04	14.5	(0.45)	I	INB	048 047
760301	V1562 Ori	05 35 31.8 -05 29 34	14.1	(0.07)	I	INB	048 047
760302	V1563 Ori	05 35 32.3 -05 18 08	13.2	(0.09)	I	IN	044 047
760303	V1564 Ori	05 35 32.3 -05 44 05	14.6	(0.18)	I	IN	044 USNO
760304	V1565 Ori	05 35 32.5 -05 26 11	13.1	(0.13)	I	INB	048 047
760305	V1566 Ori	05 35 33.1 -04 43 59	12.7	(0.14)	I	IN	044 045
760306	V1567 Ori	05 35 36.7 -05 58 56	14.1	(0.14)	I	IN	044 USNO
760307	V1568 Ori	05 35 36.7 -05 37 43	12.7	(0.10)	I	INB	044 047
760308	V1569 Ori	05 35 37.2 -05 10 30	13.8	(0.08)	I	IN	044 047
760309	V1570 Ori	05 35 37.4 -05 51 28	15.6	(0.32)	I	IN	044
760310	V1571 Ori	05 35 38.0 -05 28 22	13.7	(0.08)	I	INB	048 047
760311	V1572 Ori	05 35 38.5 -04 59 41	14.2	(0.42)	I	IN	044 045
760312	V1573 Ori	05 35 38.6 -05 09 57	15.3	(0.15)	I	IN	044 047
760313	V1574 Ori	05 35 38.9 -05 36 34	15.5	(0.25)	I	INB	044 047
760314	V1575 Ori	05 35 39.1 -05 41 00	13.5	(0.19)	I	IN	044 046
760315	V1576 Ori	05 35 39.1 -05 08 56	12.0	(0.12)	I	INB	044 047
760316	V1577 Ori	05 35 39.8 -04 44 05	13.0	(0.07)	I	IN	044 046
760317	V1578 Ori	05 35 39.9 -05 06 37	15.6	(0.33)	I	IN	044
760318	V1579 Ori	05 35 41.0 -05 06 25	14.1	(0.11)	I	IN	044 046
760319	V1580 Ori	05 35 44.6 -04 50 10	13.6	(0.21)	I	IN	044 046
760320	V1581 Ori	05 35 47.5 -05 12 18	13.7	(0.06)	I	IN	044 047
760321	V1582 Ori	05 35 47.6 -05 19 15	15.3	(0.27)	I	INB	044 047
760322	V1583 Ori	05 35 48.1 -05 31 56	13.7	(0.20)	I	INB	044 047

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	Ref.
760323	V1584	Ori	05 35 48.8 -05 00 29	14.7	(0.30)	I	IN	044 USNO
760324	V1585	Ori	05 35 52.1 -05 39 24	14.7	(0.17)	I	IN	044
760325	V1586	Ori	05 35 54.6 -05 06 28	15.5	(0.18)	I	IN	044
760326	V1587	Ori	05 35 55.0 -05 13 16	13.9	(0.08)	I	IN	044 047
760327	V1588	Ori	05 35 56.1 -04 56 55	12.8	(0.17)	I	IN	044 046
760328	V1589	Ori	05 35 56.9 -05 45 19	14.6	(0.38)	I	IN	044 USNO
760329	V1590	Ori	05 35 57.4 -05 39 51	14.5	(0.12)	I	IN	044
760330	V1591	Ori	05 35 59.0 -05 59 09	14.2	(0.16)	I	IN	044 USNO
760331	V1592	Ori	05 35 59.5 -05 37 11	14.6	(0.15)	I	INB	044 047
760332	V1593	Ori	05 35 59.9 -05 04 31	16.2	(0.19)	I	IN	044
760333	V1594	Ori	05 36 00.2 -04 43 46	14.5	(0.21)	I	IN	044 USNO
760334	V1595	Ori	05 36 00.8 -05 41 07	13.0	(0.22)	I	IN	044 046
760335	V1596	Ori	05 36 01.3 -05 19 11	15.0	(0.13)	I	INB	044 047
760336	V1597	Ori	05 36 06.4 -04 41 54	13.2	(0.13)	I	IN	044 046
760337	V1598	Ori	05 36 07.3 -05 40 22	13.0	(0.20)	I	IN	044 045
760338	V1599	Ori	05 36 09.9 -05 05 36	16.2	(0.16)	I	IN	044
760339	V1600	Ori	05 36 09.9 -05 27 31	15.5	(0.32)	I	INB	044
760340	V1601	Ori	05 36 11.4 -05 38 52	14.9	(0.14)	I	IN	044 USNO
760341	V1602	Ori	05 36 12.1 -05 33 29	15.9	(0.20)	I	INB	044
760342	V1603	Ori	05 36 13.1 -04 55 14	14.7	(0.16)	I	IN	044 USNO
760343	V1604	Ori	05 36 15.7 -04 55 20	15.4	(0.19)	I	IN	044
760344	V1605	Ori	05 36 16.4 -05 40 03	15.4	(0.24)	I	IN	044 USNO
760345	V1606	Ori	05 36 19.2 -05 00 29	15.7	(0.19)	I	IN	044 USNO
760346	V1607	Ori	05 36 24.1 -05 44 48	12.5	(0.22)	I	IN	044 046
760347	V1608	Ori	05 36 25.5 -05 18 43	15.3	(0.22):	I	IN	044 USNO
760348	V1609	Ori	05 36 25.8 -04 50 20	13.4	(0.16)	I	IN	044 USNO
760349	V1610	Ori	05 36 26.8 -05 56 30	16.2	(0.21):	I	IN	044
760350	V1611	Ori	05 36 26.8 -04 55 06	16.0	(0.30)	I	IN	044
760351	V1612	Ori	05 36 29.6 -05 20 07	13.7	(0.24)	I	INB	044 045
760352	V1613	Ori	05 36 30.0 -05 20 06	13.5	(0.22)	I	IN	044
760353	V1614	Ori	05 36 31.4 -05 25 60	16.3	(0.29)	I	IN	044
760354	V1615	Ori	05 36 31.7 -05 26 36	14.2	(0.12)	I	IN	044 USNO
760355	V1616	Ori	05 36 32.8 -06 00 50	15.7	(0.22)	I	IN	044
760356	V1617	Ori	05 36 34.3 -05 40 54	15.4	(0.12)	I	IN	044
760357	V1618	Ori	05 36 34.6 -05 32 14	12.7	(0.07)	I	IN	044 046
760358	V1619	Ori	05 36 38.1 -05 37 10	15.2	(0.12)	I	IN	044 USNO
760359	AZ	Dor	05 36 55.0 -66 33 37	6.26	6.29	V	BE	053 DM
760360	KN	Cam	05 37 29.1 +67 25 33	10.7	14.8	V	M	012 GSC
760361	V1620	Ori	05 44 04.5 +11 19 55	11.8	13.4	V	SR:	054 GSC
760362	V1621	Ori	05 44 07.8 +10 05 43	11.92	12.12	*	SR	055 GSC
760363	V1622	Ori	05 45 43.6 +09 35 36	12.6	13.8	V	SR:	054 USNO
760364	KO	Cam	05 47 44.5 +56 32 33	11.6	12.9	V	SR:	012 GSC
760365	KP	Cam	05 49 03.6 +69 09 08	11.7	12.9	V	SR:	012 GSC
760366	V507	Aur	05 51 49.5 +54 21 41	13.0	13.9	V	SR:	012 USNO
760367	V1623	Ori	05 52 27.9 +06 20 53	11.7	12.5	V	SRA	056 GSC
760368	KQ	Cam	05 56 22.6 +66 27 01	11.8	13.0	V	SR:	012 GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s ° ' "	Max m	Min m			Type	Ref.	
760369	V508	Aur	05 57 14.8 +32 22 39	12.1	(15.2		V	M	012	USNO
760370	V1624	Ori	05 57 27.5 +19 45 26	12.6	13.7		*	SR:	057	USNO
760371	V791	Mon	06 02 14.9 -10 00 59	10.32	10.59		V	IA	027	DM
760372	V792	Mon	06 03 16.0 -10 03 37	12.8	(15.5		V	M	012	USNO
760373	AE	Lep	06 03 37.0 -14 53 03	10.17	10.44		V	IA	027	DM
760374	KR	Cam	06 04 02.0 +59 32 19	11.1	12.1		V	SR:	012	GSC
760375	V1625	Ori	06 04 20.6 -02 28 52	13.5	14.2		V	SR:	012	GSC
760376	V354	Gem	06 05 01.0 +27 45 55	10.9	12.3		V	SR:	012	GSC
760377	V1626	Ori	06 05 20.1 +10 04 26	11.57	12.07		*	E	058	GSC
760378	V509	Aur	06 05 39.5 +52 24 23	12.6	14.0		V	SR:	012	USNO
760379	V1627	Ori	06 06 07.9 -01 44 02	13.4	14.8		V	SR:	012	GSC
760380	V793	Mon	06 06 21.1 -05 42 15	14.3	(15.4		V	M:	012	USNO
760381	V1628	Ori	06 06 21.5 -01 47 48	13.4	15.2		V	SR:	012	GSC
760382	V510	Aur	06 06 38.7 +37 57 55	13.6	15.1		V	SR:	012	GSC
760383	KS	Cam	06 08 22.8 +57 57 36	11.0	12.0		V	SR:	012	GSC
760384	V1629	Ori	06 08 33.6 -00 42 52	11.9	12.6		V	SR:	012	GSC
760385	V511	Aur	06 09 10.0 +50 17 27	11.8	12.3		V	SR:	012	GSC
760386	KT	Cam	06 10 50.5 +67 44 13	12.1	13.1		V	SR:	012	GSC
760387	V794	Mon	06 11 35.7 -10 01 55	12.6	(15.3		V	SR:	012	GSC
760388	V512	Aur	06 12 25.1 +43 28 15	11.9	13.5		V	SR:	012	GSC
760389	V795	Mon	06 13 47.3 -10 19 52	12.4	(15.2		V	M	012	GSC
760390	V513	Aur	06 14 14.8 +50 41 52	11.9	13.1		V	SR:	012	GSC
760391	KU	Cam	06 14 24.8 +68 38 50	11.7	12.7		V	SR:	012	GSC
760392	V1630	Ori	06 15 45.6 +00 54 47	13.5	14.5		V	LB	012	USNO
760393	OV	CMa	06 15 51.8 -12 08 37	11.9	13.4		V	SR:	012	GSC
760394	V1631	Ori	06 16 59.5 -02 06 46	13.3	(15.1		V	SR:	012	GSC
760395	V796	Mon	06 17 00.3 -08 36 08	12.3	14.0		V	SR:	012	USNO
760396	V514	Aur	06 17 10.8 +30 37 55	12.0	13.3		V	SR:	012	GSC
760397	OW	CMa	06 18 47.5 -14 13 09	13.2	14.9		V	SR:	012	GSC
760398	V1632	Ori	06 18 48.5 +00 50 54	13.2	14.0		V	SR:	012	GSC
760399	V1633	Ori	06 18 56.1 +04 09 20	12.1	(0.7	)	V	EA	140	GSC
760400	V515	Aur	06 19 12.9 +50 28 37	12.7	14.7		V	SR:	012	GSC
760401	DK	Lyn	06 19 48.3 +57 15 13	12.3	(15.3		V	M	012	GSC
760402	V1634	Ori	06 20 40.0 +06 16 08	11.62	12.16		*	SRA:	060	GSC
760403	V797	Mon	06 20 49.4 -02 10 38	14.2	(15.5		V	M:	012	USNO
760404	V516	Aur	06 21 19.5 +41 57 60	13.0	(15.0		V	M:	012	USNO
760405	V1635	Ori	06 24 54.0 +10 14 05	11.72	12.11		*	E	061	GSC
760406	V517	Aur	06 25 04.8 +51 46 54	13.2	15.0		V	SR:	012	GSC
760407	V798	Mon	06 25 21.6 -02 46 38	14.3	(15.0		V	M:	012	USNO
760408	DL	Lyn	06 25 30.9 +57 42 53	12.4	15.3		V	M	012	GSC
760409	V799	Mon	06 25 52.0 -00 52 40	11.3	12.0		V	LB	012	GSC
760410	V518	Aur	06 26 36.6 +29 20 02	10.5	11.5		V	SR:	012	GSC
760411	V800	Mon	06 26 41.2 -02 05 48	12.6	13.9		V	SR:	012	GSC
760412	V801	Mon	06 27 01.2 -04 35 44	14.3	(15.3		V	SR:	012	
760413	V802	Mon	06 28 00.6 -10 57 13	12.8	14.5		V	SR:	012	USNO
760414	OX	CMa	06 28 52.3 -27 45 14	12.5	14.0		V	SR:	012	GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s o ' "	Max m	Min m		Type	Ref.	
760415	OY	CMa	06 28 55.8 -11 51 00	12.8	(15.2	V	M:	012	GSC
760416	OZ	CMa	06 29 57.9 -15 48 07	12.3	13.3	V	SR:	012	GSC
760417	V519	Aur	06 32 42.2 +43 17 13	12.0	12.9	V	LB	012	GSC
760418	V520	Aur	06 33 24.7 +34 54 14	11.2	12.0	V	SR:	012	GSC
760419	PP	CMa	06 33 44.6 -19 42 50	14.6	(15.2	V	SR:	012	USNO
760420	V521	Aur	06 34 13.6 +45 57 59	11.0	11.7	V	SR:	012	GSC
760421	PQ	CMa	06 34 27.0 -13 41 45	12.5	15.2	V	SR:	059	GSC
760422	PR	CMa	06 34 31.9 -26 37 56	12.2	13.9	V	SR:	012	GSC
760423	PS	CMa	06 35 43.3 -26 22 27	12.5	13.3	V	SR:	012	GSC
760424	PT	CMa	06 36 39.2 -13 05 14	11.5	12.3	V	SR:	012	GSC
760425	V522	Aur	06 38 07.2 +34 59 21	13.2	(14.7	V	SR:	012	USNO
760426	AR	Col	06 39 14.5 -33 22 10	12.3	13.3	V	SR:	012	GSC
760427	V803	Mon	06 40 36.6 +09 48 22	15.5	(0.20Ic)	V	IN	062	063
760428	V804	Mon	06 40 44.3 +09 47 31	15.5:	(0.17)	Ic	IN	063	063
760429	V805	Mon	06 40 45.1 +09 45 42	15.7	(0.25Ic)	V	IN	063	063
760430	PU	CMa	06 40 47.7 -24 23 15	11.5	15.1	V	UGSU:	064	USNO
760431	V806	Mon	06 40 59.7 +09 51 48	16.1	(0.15Ic)	V	IN	062	063
760432	V807	Mon	06 41 02.6 +09 35 13	15.3	(0.12Ic)	V	IN	062	063
760433	V808	Mon	06 41 03.7 +09 27 40	16.3	(0.12Ic)	V	IN	062	063
760434	V809	Mon	06 41 04.2 +09 34 57	21.6	(0.54Ic)	V	IN	062	063
760435	V810	Mon	06 41 04.4 +09 51 51	12.3	(0.11Ic)	V	IN	062	063
760436	V811	Mon	06 41 05.1 +09 51 44	15.1	(0.16Ic)	V	IN	062	063
760437	V812	Mon	06 41 05.3 +09 33 14	14.8	(0.12Ic)	V	IN	063	063
760438	V813	Mon	06 41 05.6 +09 54 18	15.9:	(0.09Ic)	V	IN	062	063
760439	V814	Mon	06 41 05.9 +09 27 18	16.3	16.6	V	IN	063	063
760440	V815	Mon	06 41 06.3 +09 29 31	17.0:	(0.14Ic)	V	IN:	063	063
760441	V816	Mon	06 41 07.7 +09 28 15	16.2	16.5	V	IN	063	063
760442	V817	Mon	06 41 09.1 +09 53 01	16.0:	(0.35Ic)	V	IN	062	063
760443	V818	Mon	06 41 09.8 +09 27 14	14.0	(0.23Ic)	V	IN	062	063
760444	V819	Mon	06 41 11.2 +09 26 39	15.5:	(0.17)	Ic	IN	062	063
760445	V820	Mon	06 41 12.8 +09 52 44	14.8	(0.20Ic)	V	IN	062	063
760446	V821	Mon	06 41 17.8 +09 29 02	18.1	(0.26Ic)	V	IN	062	063
760447	KV	Cam	06 41 25.7 +64 50 32	11.4	11.9	V	SR:	012	GSC
760448	PV	CMa	06 45 03.3 -25 22 39	13.2	13.8	V	SR:	012	GSC
760449	PW	CMa	06 47 09.1 -25 21 18	13.2	14.8	V	SR:	012	GSC
760450	KW	Cam	06 48 35.3 +64 20 60	10.3	11.4	V	SR:	012	GSC
760451	DM	Lyn	06 49 44.1 +59 11 17	11.9	12.7	V	SR:	012	GSC
760452	V355	Gem	07 00 36.5 +26 08 18	10.5	(15.0	V	M	054	GSC
760453	PX	CMa	07 03 03.8 -20 49 13	18.72	19.09	Ic	EW	065	065
760454	PY	CMa	07 03 04.1 -20 50 23	18.27	18.64	Ic	EW	065	065
760455	PZ	CMa	07 03 05.0 -20 49 50	16.63	17.11	Ic	EA	065	065
760456	QQ	CMa	07 03 05.1 -20 49 51	18.60	18.80	Ic	EW	065	065
760457	QR	CMa	07 03 07.3 -20 49 17	17.68	18.00	Ic	EW	065	065
760458	QS	CMa	07 03 07.7 -20 49 12	17.71	17.98	Ic	E/RS	065	065
760459	QT	CMa	07 09 54.7 -14 31 41	12.5	14.2	V	SR:	012	GSC
760460	BZ	CMi	07 11 52.6 +04 04 05	11.4	11.9	*	EA:	066	GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s o ' "	Max m	Min m		Type	Ref.
760461	V446	Pup	07 13 19.7 -35 00 34	13.3	14.2	V	SR:	012 GSC
760462	QU	CMa	07 13 54.6 -25 49 20	11.76	12.14	V	EB	067 068
760463	V356	Gem	07 14 26.5 +24 42 40	6.89	(0.04u)	V	ACV	069 DM
760464	QV	CMa	07 15 25.4 -17 49 19	12.1	(14.8	V	M	070 USNO
760465	QW	CMa	07 17 44.2 -28 14 50	13.5	14.1	V	LB	012 USNO
760466	QX	CMa	07 18 34.4 -24 57 27	11.13	11.19	b	LBV:	071 071
760467	QY	CMa	07 18 38.8 -24 56 16	10.59	10.64	b	DSCTC:	071 071
760468	V822	Mon	07 18 49.3 -08 03 39	12.8	14.3	V	SR:	012 GSC
760469	QZ	CMa	07 19 10.2 -29 52 34	12.4	14.7	V	SR:	012 GSC
760470	V335	CMa	07 19 37.0 -31 17 45	12.0	12.8	V	LB:	012 GSC
760471	V336	CMa	07 20 05.4 -26 02 30	14.5	15.2	V	SR:	012 USNO
760472	V337	CMa	07 21 20.0 -20 22 18	12.6	14.5	V	SR:	012 USNO
760473	V338	CMa	07 21 35.2 -15 44 28	12.3	13.5	V	SR:	012 GSC
760474	V339	CMa	07 21 35.4 -20 27 36	11.0	11.9	V	LB:	012 GSC
760475	V340	CMa	07 21 36.7 -28 57 43	12.1	13.0	V	SR:	012 GSC
760476	V341	CMa	07 21 42.2 -28 29 57	12.3	12.9	V	SR:	012 GSC
760477	V342	CMa	07 21 43.4 -15 35 28	13.3	15.1	V	SR:	012 USNO
760478	V343	CMa	07 21 49.1 -28 38 40	11.8	12.7	V	SR:	012 GSC
760479	V823	Mon	07 22 18.1 -09 56 02	12.3	13.5	V	SR:	012 GSC
760480	V824	Mon	07 22 47.2 -08 48 55	13.7	(15.3	V	M	012 USNO
760481	V344	CMa	07 22 49.5 -24 38 20	13.6	14.8	V	SR:	012 GSC
760482	V345	CMa	07 23 50.1 -15 33 15	13.4	14.1	V	SR:	012 USNO
760483	V523	Aur	07 24 03.5 +41 26 02	13.3	14.7	*	E:	072 GSC
760484	V357	Gem	07 24 28.4 +14 34 07	11.7	12.7	V	SR:	012 GSC
760485	V825	Mon	07 24 33.3 -00 56 40	12.4	13.1	V	SR:	012 GSC
760486	CC	CMi	07 24 51.0 +12 08 17	11.8	12.9	V	SR:	012 GSC
760487	CD	CMi	07 25 27.4 +10 18 24	11.5	11.8	*	SR	073 GSC
760488	CE	CMi	07 25 28.5 +00 35 13	14.5	(15.0	V	M:	012 USNO
760489	V346	CMa	07 25 30.1 -29 51 23	11.9	12.4	V	SR:	012 GSC
760490	V347	CMa	07 25 36.1 -16 01 35	13.4	14.3	V	SR:	012 USNO
760491	V348	CMa	07 25 40.3 -22 02 28	12.0	13.5	V	SR:	012 GSC
760492	V349	CMa	07 25 58.2 -11 44 22	13.2	(15.4	V	M	012
760493	CF	CMi	07 26 33.2 +10 03 56	12.29	12.59	*	SR	074 GSC
760494	CG	CMi	07 26 46.9 +02 25 58	12.3	13.1	V	LB	012 USNO
760495	CH	CMi	07 27 44.1 +09 19 04	11.1	12.5	V	SR:	012 GSC
760496	V358	Gem	07 27 47.6 +18 14 37	11.5	12.8	V	SR:	012 GSC
760497	V826	Mon	07 28 28.2 -00 45 04	12.3	(15.3	V	M	012 USNO
760498	V827	Mon	07 29 35.5 -09 15 33	7.96	8.00	V	ACV	075 DM
760499	V447	Pup	07 29 50.8 -27 28 14	12.0	12.8	V	LB	012 GSC
760500	V448	Pup	07 30 07.4 -29 16 03	12.4	13.0	V	SR:	012 GSC
760501	V359	Gem	07 30 31.5 +22 36 56	13.0	14.3	V	SR:	012 GSC
760502	V828	Mon	07 31 38.2 -11 01 38	10.9	12.2	V	LB	012 GSC
760503	V449	Pup	07 31 38.3 -22 47 05	13.3	14.1	V	SR:	012 USNO
760504	V450	Pup	07 31 42.3 -30 27 36	11.8	13.2	V	SR:	012 GSC
760505	DN	Lyn	07 31 42.5 +47 33 23	11.7	14.3	V	M:	012 GSC
760506	V451	Pup	07 32 05.5 -26 38 26	12.0	13.1	V	SR:	012 GSC

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 o ' "	Max m	Min m		Type	Ref.	
760507	V452	Pup	07 32 21.3	-29 04 54	13.1	13.9	V	SR:	012	USNO
760508	V453	Pup	07 32 24.7	-23 58 06	13.1	15.0	V	SR:	012	USNO
760509	CI	CMi	07 33 17.9	+11 02 08	13.0	15.0	V	SR:	012	GSC
760510	V454	Pup	07 34 26.8	-16 03 33	13.6	14.4	V	LB:	012	USNO
760511	V455	Pup	07 34 56.2	-22 50 04	13.2	(15.2	V	M:	012	USNO
760512	CK	CMi	07 35 48.0	+11 01 15	11.3	12.5	V	SR:	012	GSC
760513	V456	Pup	07 35 58.0	-18 19 52	11.35	(1.0)	V	SR:	012	GSC
760514	V457	Pup	07 35 59.9	-19 52 57	11.8	13.0	V	SR:	012	GSC
760515	V458	Pup	07 36 34.8	-21 06 47	11.8	12.8	V	SR:	012	GSC
760516	V459	Pup	07 37 13.1	-18 06 45	11.9	12.4	V	SR:	012	GSC
760517	V460	Pup	07 37 25.1	-12 04 10	14.08	14.12	V	DSCTC	077	077
760518	V461	Pup	07 37 26.1	-13 00 09	14.3	15.2	V	SR:	012	USNO
760519	V462	Pup	07 37 31.2	-12 02 06	14.66	14.91	V	EB:	077	077
760520	V463	Pup	07 37 31.6	-12 02 11	13.46	13.50	V	DSCTC	077	077
760521	V464	Pup	07 37 35.7	-12 03 59	13.39	13.42	V	DSCTC	077	077
760522	V465	Pup	07 37 40.5	-12 01 26	13.37	13.48	V	DSCT	077	077
760523	V445	Pup	07 37 56.9	-25 56 59	8.6	(14.	V	NC:	257	USNO
760524	V466	Pup	07 38 45.3	-22 07 09	13.2	13.9	V	LB	012	USNO
760525	V829	Mon	07 39 39.5	-10 43 05	14.3	(15.3	V	M	012	USNO
760526	V467	Pup	07 39 42.0	-22 22 18	11.2	12.5	V	SR:	012	GSC
760527	CL	CMi	07 39 47.7	+03 12 42	11.5	12.3	V	SR:	012	GSC
760528	V468	Pup	07 39 58.0	-37 34 46	5.92	6.02	V	BE	078	DM
760529	CM	CMi	07 40 00.7	+05 59 23	11.7	12.9	V	SR:	012	GSC
760530	V469	Pup	07 40 00.8	-22 43 35	11.6	12.7	V	SR:	012	GSC
760531	V470	Pup	07 40 42.8	-22 10 36	12.2	(15.0	V	M	012	USNO
760532	V471	Pup	07 41 06.0	-26 25 19	12.1	14.6	V	SR:	012	USNO
760533	V360	Gem	07 42 04.1	+15 20 33	11.0	12.1	V	SR:	012	079
760534	V472	Pup	07 42 25.7	-18 09 09	12.3	13.3	V	SR:	012	USNO
760535	V473	Pup	07 42 31.6	-17 54 59	11.20	(0.8)	V	SR:	012	GSC
760536	V361	Gem	07 42 46.4	+23 09 46	12.0	12.6	V	SR:	012	GSC
760537	V474	Pup	07 43 20.2	-16 31 01	10.82	(0.8)	V	SR:	012	GSC
760538	V475	Pup	07 43 38.1	-31 53 22	12.5	(15.1	V	M:	012	USNO
760539	V476	Pup	07 44 15.1	-25 04 17	11.9	13.5	V	SR:	012	USNO
760540	V477	Pup	07 45 02.4	-15 00 49	12.8	13.9	V	SR:	012	GSC
760541	V478	Pup	07 45 31.8	-12 49 12	13.1	13.8	V	LB	012	GSC
760542	DO	Lyn	07 45 42.3	+39 32 49	7.17	(0.05)	V	GDOR	080	DM
760543	CN	CMi	07 45 51.4	+00 55 40	13.1	(15.3	V	M	012	USNO
760544	V479	Pup	07 46 52.7	-27 19 17	11.8	14.2	V	SR:	012	USNO
760545	V480	Pup	07 47 48.3	-29 53 43	12.9	14.1	V	SR:	012	USNO
760546	DP	Lyn	07 47 50.0	+58 59 26	11.9	13.1	V	SR:	012	GSC
760547	V481	Pup	07 48 53.3	-35 06 52	13.0	13.5	V	LB:	012	GSC
760548	V482	Pup	07 49 13.1	-23 06 21	13.1	15.0	V	SR:	012	GSC
760549	V483	Pup	07 50 32.7	-18 06 04	13.0	14.7	V	SR:	012	USNO
760550	V484	Pup	07 51 10.2	-17 57 21	12.5	14.2	V	SR:	012	USNO
760551	V485	Pup	07 51 33.9	-35 14 05	12.1	13.5	V	SR:	012	GSC
760552	V486	Pup	07 52 05.4	-30 05 06	11.5	12.1	V	LB:	012	GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s o ' "	Max m	Min m		Type	Ref.
760553	CO	CMi	07 52 11.1 +10 29 01	12.6	13.7	V	SR:	012 GSC
760554	V487	Pup	07 52 16.3 -24 27 52	11.9	13.0	V	SR:	012 GSC
760555	V488	Pup	07 52 38.5 -30 07 05	12.6	13.4	V	LB	012 GSC
760556	V830	Mon	07 52 44.9 -05 07 11	12.6	13.8	V	SR:	012 GSC
760557	V362	Gem	07 53 23.8 +14 28 11	10.4	11.2	V	SR:	012 GSC
760558	V489	Pup	07 53 32.6 -29 02 34	12.5	13.1	V	SR:	012 GSC
760559	V490	Pup	07 53 54.7 -30 23 55	13.2	14.3	V	LB	012 GSC
760560	V491	Pup	07 53 56.1 -29 12 31	12.3	12.9	V	SR:	012 GSC
760561	V492	Pup	07 54 05.3 -16 17 16	11.2	12.7	V	SR:	012 GSC
760562	V493	Pup	07 54 27.4 -34 08 18	11.72	(0.7)	V	SR:	012 GSC
760563	V494	Pup	07 54 27.9 -32 20 58	10.9	12.0	V	SR:	012 GSC
760564	V495	Pup	07 55 06.3 -19 09 24	12.8	14.4	V	SR:	012 GSC
760565	V496	Pup	07 55 17.2 -32 27 25	11.3	12.2	V	GCAS:	012 GSC
760566	V497	Pup	07 55 17.6 -29 28 22	12.8	13.7	V	SR:	012 GSC
760567	V498	Pup	07 55 54.1 -12 43 23	13.3	14.6	V	SR:	012 USNO
760568	V499	Pup	07 56 30.0 -23 41 21	13.4	14.1	V	SR:	012 USNO
760569	V500	Pup	07 56 43.0 -28 15 16	11.4	11.9	V	SR:	012 GSC
760570	GR	Cnc	07 56 54.0 +09 42 38	12.4	15.2	V	M	012 GSC
760571	CP	CMi	07 56 56.5 +03 22 28	13.5	14.5	V	SR:	012 GSC
760572	V363	Gem	07 56 58.0 +31 48 53	11.2	12.3	V	SR:	012 GSC
760573	V501	Pup	07 57 24.1 -28 57 39	13.6	(14.5	V	M:	012 GSC
760574	V831	Mon	07 57 43.2 -00 41 06	11.2	14.0	V	M	012 GSC
760575	V502	Pup	07 57 53.2 -31 33 57	12.6	13.1	V	SR:	012 GSC
760576	V503	Pup	07 58 08.4 -30 55 39	11.6	12.3	V	SR:	012 GSC
760577	V832	Mon	07 58 43.5 -07 02 12	13.2	14.2	V	SR:	012 GSC
760578	V504	Pup	07 59 15.3 -31 20 06	11.6	12.4	V	SR:	012 GSC
760579	CQ	CMi	07 59 53.8 +01 50 17	14.0	14.7	V	SR:	012 GSC
760580	V505	Pup	08 00 27.8 -14 06 14	13.6	(15.1	V	M:	012 USNO
760581	V506	Pup	08 00 44.1 -15 45 23	12.6	13.1	V	SR:	012 GSC
760582	V507	Pup	08 00 55.8 -24 26 44	13.8	(14.5	V	M:	012 USNO
760583	V508	Pup	08 01 35.8 -31 53 49	13.0	13.8	V	SR:	012 GSC
760584	V364	Gem	08 01 37.5 +29 00 39	10.9	11.5	V	SR:	012 GSC
760585	V509	Pup	08 02 25.5 -30 32 16	11.3	12.3	V	SR:	012 GSC
760586	V510	Pup	08 02 40.7 -24 04 43	11.7	12.2	V	SRD:	012 GSC
760587	V511	Pup	08 03 10.7 -12 14 10	12.4	13.3	V	SR:	012 GSC
760588	V512	Pup	08 03 19.2 -31 38 01	11.7	12.7	V	SR:	012 GSC
760589	V513	Pup	08 03 22.2 -31 30 12	10.8	11.7	V	SR:	012 GSC
760590	V514	Pup	08 03 30.5 -18 00 31	11.7	13.0	V	SR:	012 GSC
760591	V515	Pup	08 03 42.4 -31 26 46	11.4	12.2	V	SR:	012 GSC
760592	V516	Pup	08 03 45.6 -47 48 44	16.2	18.5	B	E+XM	081 USNO
760593	V833	Mon	08 04 30.7 -03 07 48	11.8	14.8	V	M:	012 USNO
760594	V365	Gem	08 04 33.6 +28 05 55	12.4	13.6	V	SR:	012 GSC
760595	V517	Pup	08 04 36.4 -31 30 35	12.5	13.3	V	SR:	012 GSC
760596	V834	Mon	08 05 27.2 -09 41 01	12.8	13.6	V	SR:	012 GSC
760597	CR	CMi	08 06 02.8 +03 09 47	11.5	12.5	V	SR:	012 GSC
760598	CS	CMi	08 06 21.6 +03 23 02	12.3	13.5	V	SR:	012 GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s	° ' "	Max m	Min m		Type	Ref.
760599	V835	Mon	08 06 30.1	-04 26 23	12.6	13.8	V	SR:	012 GSC
760600	V518	Pup	08 06 51.4	-15 33 24	13.0	14.2	V	SR:	012 USNO
760601	V519	Pup	08 07 03.5	-32 38 45	11.1	12.0	V	SR:	012 GSC
760602	V520	Pup	08 07 03.9	-32 21 32	12.7	13.2	V	RR:	012 GSC
760603	V521	Pup	08 07 05.1	-29 47 44	10.4	11.68	V	SR:	012 GSC
760604	V522	Pup	08 07 28.9	-32 23 32	12.2	12.9	V	SR:	012 GSC
760605	V523	Pup	08 07 47.5	-26 33 08	12.8	13.7	V	RRAB:	082 GSC
760606	V524	Pup	08 07 52.4	-26 32 35	12.9	13.6	V	SR:	012 GSC
760607	V836	Mon	08 07 58.3	-10 29 31	10.68	(0.7)	V	SR:	012 GSC
760608	V525	Pup	08 08 03.0	-22 42 56	12.4	12.9	V	SR:	012 GSC
760609	V526	Pup	08 08 06.6	-32 57 11	10.9	11.8	V	SR:	012 GSC
760610	CT	CMi	08 08 16.2	+00 43 37	12.0	12.5	V	SR:	012 GSC
760611	V837	Mon	08 08 22.4	-01 05 18	10.72	(0.7)	V	SR:	012 GSC
760612	V527	Pup	08 08 39.6	-25 43 22	11.4	12.4	V	SR:	012 GSC
760613	V528	Pup	08 09 04.8	-28 29 06	12.0	12.9	V	SR:	012 GSC
760614	V529	Pup	08 09 06.9	-32 25 22	12.7	13.4	V	SR:	012 GSC
760615	V530	Pup	08 09 16.9	-32 48 24	12.8	13.8	V	SR:	012 GSC
760616	CU	CMi	08 09 25.5	+05 08 20	12.7	13.7	V	SR:	012 GSC
760617	V531	Pup	08 10 10.0	-29 32 03	10.58	11.6	V	SR:	012 GSC
760618	V532	Pup	08 10 29.1	-32 47 21	12.2	14.5	V	SR:	012
760619	CV	CMi	08 11 09.5	+00 40 31	10.57	(0.7)	V	SR:	012 GSC
760620	V533	Pup	08 11 13.5	-27 53 26	13.0	13.8	V	SR:	012 GSC
760621	V534	Pup	08 12 03.4	-20 21 39	11.7	12.3	V	SR:	012 GSC
760622	V535	Pup	08 12 04.0	-20 02 26	12.4	13.1	V	SR:	012 GSC
760623	V536	Pup	08 12 12.7	-31 14 14	12.0	13.8	V	SR:	012 GSC
760624	V537	Pup	08 12 30.6	-30 09 05	12.3	13.0	V	SR:	012 GSC
760625	V538	Pup	08 13 11.3	-19 56 29	12.9	13.7	V	SR:	012 GSC
760626	V539	Pup	08 13 38.1	-25 57 36	13.5	14.2	V	SR:	012 USNO
760627	V362	Hya	08 14 04.8	-08 38 25	12.8	13.8	V	SR:	012 GSC
760628	V540	Pup	08 14 36.8	-30 58 24	12.1	13.4	V	SR:	012 GSC
760629	GS	Cnc	08 15 06.3	+28 31 10	10.9	12.1	V	SR:	012 DM
760630	V363	Hya	08 15 11.2	-04 27 51	12.8	14.4	V	SR:	012 USNO
760631	KO	UMa	08 15 42.1	+66 10 32	7.18	(0.04)	V	GDOR	080 DM
760632	V541	Pup	08 15 46.2	-34 23 58	12.4	13.7	V	SR:	012 GSC
760633	V542	Pup	08 15 60.0	-31 25 55	12.7	13.3	V	SR:	012 GSC
760634	V543	Pup	08 16 08.2	-31 12 28	13.3	13.9	V	SR:	012 GSC
760635	V544	Pup	08 16 13.5	-32 35 05	11.3	12.4	V	SR:	012 GSC
760636	V545	Pup	08 16 54.2	-30 13 19	13.0	13.6	V	SR:	012 GSC
760637	V546	Pup	08 17 13.2	-34 17 15	10.5	11.2	V	SR:	012 DM
760638	V547	Pup	08 18 04.0	-28 21 51	11.9	13.0	V	SR:	083 GSC
760639	V548	Pup	08 18 45.5	-31 51 10	11.7	12.8	V	SR:	012 GSC
760640	V549	Pup	08 18 59.3	-34 50 38	12.6	13.5	V	SR:	012 GSC
760641	V550	Pup	08 19 29.9	-32 04 24	13.1	13.6	V	SR:	012 GSC
760642	V551	Pup	08 20 20.9	-32 13 56	12.3	(14.3	V	SR:	012 GSC
760643	V552	Pup	08 20 57.1	-19 15 04	9.09	(0.5)	V	SRD	084 DM
760644	V364	Hya	08 21 27.6	-00 33 49	11.09	(0.5)	V	SR:	012 GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s	o ’ "	Max m	Min m		Type	Ref.
760645	V553	Pup	08 21 45.8	-13 42 13	14.0	14.6	V	SR:	012 USNO
760646	V365	Hya	08 21 53.2	-09 40 12	11.9	13.1	V	SR:	012 GSC
760647	GT	Cnc	08 22 01.4	+13 37 04	10.8	12.4	V	SR:	012 GSC
760648	V554	Pup	08 22 02.8	-17 41 40	14.3	14.8	V	SR:	012 USNO
760649	V555	Pup	08 22 14.9	-18 01 22	12.1	14.7	V	SR:	012 GSC
760650	V556	Pup	08 22 37.4	-18 03 13	11.6	12.5	V	SR:	012 GSC
760651	V557	Pup	08 22 53.4	-15 18 28	11.3	13.7	V	SR:	012 USNO
760652	V558	Pup	08 23 10.4	-33 12 13	12.0	(14.5	V	M:	012 USNO
760653	V559	Pup	08 23 34.6	-21 31 44	12.5	13.2	V	SR:	012 GSC
760654	DQ	Lyn	08 23 41.0	+37 28 11	11.46	11.92	B	RRC	085 GSC
760655	V560	Pup	08 24 03.1	-26 44 59	11.2	12.0	V	SR:	012 DM
760656	DR	Lyn	08 24 24.5	+50 00 51	11.6	14.3	V	EA	012 GSC
760657	V561	Pup	08 24 25.9	-24 21 23	11.2	14.8	V	M:	012 USNO
760658	V562	Pup	08 24 45.9	-33 45 13	11.3	12.8	V	SR:	012 GSC
760659	V563	Pup	08 24 48.5	-33 07 31	11.8	12.8	V	SR:	012 GSC
760660	V564	Pup	08 25 02.6	-25 22 00	11.29	(0.8)	V	SR:	012 DM
760661	V565	Pup	08 25 08.9	-22 41 38	11.4	(15.1	V	M	086 USNO
760662	V566	Pup	08 25 45.1	-33 18 00	12.4	13.1	V	SR:	012 GSC
760663	GU	Cnc	08 26 13.9	+15 21 39	10.6	11.7	V	SR:	012 GSC
760664	V567	Pup	08 26 39.2	-13 28 22	11.4	12.4	V	SR:	012 GSC
760665	AS	Pyx	08 27 21.9	-26 14 58	14.3	14.8	V	RR:	012 GSC
760666	V568	Pup	08 27 29.8	-12 43 27	12.0	13.5	V	SR:	012 GSC
760667	GV	Cnc	08 27 40.5	+19 15 44	11.4	13.1	V	SR:	012 GSC
760668	AT	Pyx	08 28 40.7	-33 46 23	12.7	(14.0	V	INB	012 260
760669	AU	Pyx	08 29 22.6	-33 33 32	12.1	13.0	V	SR:	012 GSC
760670	AV	Pyx	08 31 01.2	-21 47 38	12.2	(14.2	V	M:	087 USNO
760671	AW	Pyx	08 31 52.8	-26 37 08	11.2	12.5	V	SR:	012 DM
760672	AX	Pyx	08 31 53.3	-34 13 18	12.6	13.8	V	SR:	012 GSC
760673	AY	Pyx	08 32 06.5	-34 11 31	12.4	13.0	V	SR:	012 GSC
760674	AZ	Pyx	08 32 47.2	-34 14 29	11.7	12.5	V	SR:	012 GSC
760675	V366	Hya	08 34 26.3	-16 39 42	12.9	14.3	V	SR:	012 GSC
760676	BB	Pyx	08 34 33.0	-21 45 35	13.0	14.1	V	SR:	012 GSC
760677	V367	Hya	08 34 60.0	-17 22 08	12.5	13.4	V	SR:	012 GSC
760678	BC	Pyx	08 35 26.4	-27 16 12	13.2	14.0	V	SR:	012 GSC
760679	V368	Hya	08 35 40.6	-16 35 40	13.1	14.2	V	SR:	012 GSC
760680	BD	Pyx	08 36 03.6	-19 15 09	12.4	14.5	V	SR:	012 USNO
760681	V369	Hya	08 36 29.5	-16 01 56	11.8	12.9	V	SR:	012 GSC
760682	V370	Hya	08 37 13.6	-16 21 41	10.8	11.8	V	SR:	012 DM
760683	BE	Pyx	08 37 45.2	-22 04 41	12.7	13.2	V	SR:	012 GSC
760684	BF	Pyx	08 38 17.9	-18 14 39	10.8	12.0	V	SR:	012 GSC
760685	BG	Pyx	08 38 34.2	-17 40 41	13.6	14.3	V	SR:	012 GSC
760686	V371	Hya	08 40 24.2	-14 49 20	11.0	(13.8	V	M	088 USNO
760687	BH	Pyx	08 43 41.1	-32 31 39	10.1	(15.0	V	M	089 090
760688	delta	Vel	08 44 42.2	-54 42 32	1.96	(0.4)	V	EA	076 DM
760689	KP	UMa	08 47 50.8	+66 12 38	7.87	(0.04)	V	ELL	091 DM
760690	GW	Cnc	08 48 12.7	+21 07 14	12.1	13.1	V	L:	012 GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0		Max	Min		Type	Ref.	
			h m s	o ' "	m	m				
760691	BI	Pyx	08 50 17.8	-23 18 44	11.42	(0.6)	V	SR:	012	DM
760692	GX	Cnc	08 50 49.5	+12 17 16	11.72	(0.08)	V	RS	092	GSC
760693	BK	Pyx	08 51 20.4	-19 37 01	11.45	(1.0)	V	SR:	012	GSC
760694	V372	Hya	08 51 48.1	-19 09 24	10.4	11.6	V	SR:	012	DM
760695	V373	Hya	08 52 36.2	-19 13 30	13.1	14.7	V	SR:	012	GSC
760696	BL	Pyx	08 59 02.3	-23 16 30	10.8	11.4	V	SR:	012	DM
760697	V374	Hya	09 00 14.8	-17 38 25	14.3	15.0	V	SR:	012	GSC
760698	V375	Hya	09 00 16.2	-17 39 23	13.3	(15.3	V	M:	012	GSC
760699	V376	Hya	09 00 16.6	-16 48 31	11.35	(1.1)	V	SR:	012	DM
760700	V377	Hya	09 00 55.5	-15 30 52	12.4	13.2	V	SR:	012	GSC
760701	BM	Pyx	09 01 24.4	-24 05 53	13.8	14.5	V	SR:	012	GSC
760702	V378	Hya	09 01 37.0	-17 08 39	11.6	12.1	V	SR:	012	GSC
760703	BN	Pyx	09 02 20.4	-23 47 01	14.4	15.3	V	SR:	012	GSC
760704	BO	Pyx	09 02 49.8	-19 57 29	14.2	14.8	V	SR:	012	GSC
760705	BP	Pyx	09 03 53.2	-23 49 02	11.96	(0.9)	V	SR:	012	DM
760706	BQ	Pyx	09 04 13.7	-29 53 01	13.2	14.0	V	L:	012	GSC
760707	BR	Pyx	09 04 14.7	-29 29 40	12.7	(15.2	V	M:	012	GSC
760708	BS	Pyx	09 04 43.4	-20 07 45	11.5	12.1	V	SR:	012	GSC
760709	BT	Pyx	09 05 02.8	-28 14 51	13.2	13.8	V	SR:	012	GSC
760710	BU	Pyx	09 05 09.0	-19 57 25	12.7	13.3	V	SR:	012	GSC
760711	BV	Pyx	09 06 30.6	-21 01 53	12.8	13.6	V	SR:	012	GSC
760712	V379	Hya	09 06 39.0	-19 18 45	12.7	14.8	V	SR:	012	GSC
760713	DS	Lyn	09 06 48.0	+35 51 40	12.7	13.5	V	LB:	012	GSC
760714	BW	Pyx	09 06 53.8	-24 40 05	9.93	(0.5)	V	SR:	012	DM
760715	BX	Pyx	09 07 10.3	-27 16 50	11.9	13.0	V	SR:	012	GSC
760716	BY	Pyx	09 07 34.5	-27 31 07	10.05	(0.6)	V	SR:	012	DM
760717	BZ	Pyx	09 08 10.1	-28 19 10	11.46	(0.7)	V	SR:	012	DM
760718	CC	Pyx	09 09 28.6	-22 13 05	13.3	(15.0	V	M:	012	USNO
760719	CD	Pyx	09 09 40.5	-24 37 59	12.3	12.9	V	SR:	012	GSC
760720	V380	Hya	09 09 42.4	-17 40 43	11.48	(0.6)	V	SR:	012	GSC
760721	CE	Pyx	09 09 43.8	-27 15 32	11.58	(0.7)	V	SR:	012	DM
760722	GY	Cnc	09 09 50.6	+18 49 47	12.5	17.80	V	UGSU:+E	093	270
760723	V381	Hya	09 12 48.4	-23 21 47	10.47	(0.5)	V	SR:	012	DM
760724	V382	Hya	09 13 24.1	-15 07 34	11.26	(0.6)	V	SR:	012	GSC
760725	V383	Hya	09 13 55.7	-17 46 40	12.0	13.6	V	SR:	012	GSC
760726	CF	Pyx	09 14 26.0	-24 31 58	10.3	11.1	V	SR:	012	DM
760727	CG	Pyx	09 14 49.4	-26 41 28	13.0	14.2	V	SR:	012	GSC
760728	DT	Lyn	09 14 55.4	+45 23 41	14.9	(0.07*)	B	RPHS	094	095
760729	CH	Pyx	09 15 19.9	-24 44 16	11.1	11.6	V	SR:	012	DM
760730	GZ	Cnc	09 15 51.7	+09 00 50	13.1	15.4	V	UG	261	GSC
760731	HH	Cnc	09 16 50.7	+28 49 43	13.7	18.	V	UGSS	096	USNO
760732	CI	Pyx	09 17 06.0	-28 35 57	11.62	(0.5)	V	SR:	012	GSC
760733	KQ	UMa	09 17 20.2	+68 38 06	12.9	14.4	V	L:	012	GSC
760734	V384	Hya	09 17 26.2	-22 48 11	13.1	14.2	V	SR:	012	GSC
760735	CK	Pyx	09 17 53.8	-29 05 22	13.2	13.8	V	SR:	012	GSC
760736	CL	Pyx	09 22 18.6	-28 27 50	12.0	13.1	V	SR:	012	GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0		Max	Min		Type	Ref.
			h m s	o ’ "	m	m			
760737	CM	Pyx	09 23 15.7	-28 45 23	11.12	(0.6)	V	SR:	012 DM
760738	V385	Hya	09 29 36.9	-22 05 23	10.85	(0.7)	V	SR:	012 DM
760739	V386	Hya	09 31 02.5	-23 42 07	12.4	13.2	V	SR:	012 DM
760740	V387	Hya	09 33 22.4	-20 06 28	13.4	14.7	V	SR:	012 USNO
760741	V388	Hya	09 33 57.9	-19 55 36	12.7	13.8	V	SR:	012 GSC
760742	V389	Hya	09 34 47.4	-21 52 35	11.77	(0.5)	V	SR:	012 GSC
760743	KR	UMa	10 01 27.7	+55 53 28	15.00	(1.25)	g	NL:	097 098
760744	BD	Ant	10 18 06.4	-36 02 31	11.5	(14.9	V	M	099 USNO
760745	KS	UMa	10 20 26.7	+53 04 33	12.2	16.2	V	UGSU	100 USNO
760746	V383	Vel	10 21 41.8	-49 49 24	12.5	17.	P	UGSS	101 101
760747	WX	LMi	10 26 27.4	+38 45 05	16.4	(1.27)	R	AM	102 USNO
760748	UZ	Sex	10 28 34.8	-00 00 29	13.83	(0.02R)	V	R	103 103
760749	V542	Car	10 33 41.8	-64 13 46	11.75	(0.04)	V	BY	104 105
760750	V543	Car	10 35 47.3	-64 18 46	14.61	(0.17)	V	BY	104 105
760751	V544	Car	10 36 18.3	-64 14 57	15.14	(0.17)	V	BY	104 105
760752	V545	Car	10 36 26.4	-65 00 17	14.35	(0.10)	V	BY	104 105
760753	V546	Car	10 36 38.1	-64 47 54	12.73	(0.15)	V	BY	104 105
760754	V547	Car	10 37 22.3	-64 43 20	15.08	(0.08)	V	BY	104 105
760755	V548	Car	10 37 49.5	-64 00 51	15.06	(0.21)	V	BY	104 105
760756	V549	Car	10 39 55.3	-63 36 23	14.88	(0.10)	V	BY	104 105
760757	V550	Car	10 39 55.9	-63 59 30	12.14	(0.11)	V	BY	104 105
760758	V551	Car	10 40 30.1	-64 42 17	14.75	(0.08)	V	BY	104 105
760759	V552	Car	10 40 51.3	-64 42 48	12.19	(0.21)	V	BY	104 105
760760	V553	Car	10 41 00.0	-64 20 01	15.39	(0.10)	V	BY	104 105
760761	V554	Car	10 41 45.4	-64 28 03	13.64	(0.21)	V	BY	104 105
760762	V555	Car	10 42 07.1	-64 46 08	11.57	(0.07)	V	BY	104 106
760763	V556	Car	10 42 28.1	-64 36 12	15.59	(0.07)	V	BY	104 105
760764	V557	Car	10 42 41.5	-64 21 05	10.57	(0.21)	V	BY	104 107
760765	V558	Car	10 44 06.8	-63 59 36	11.07	(0.08)	V	BY	104 105
760766	V559	Car	10 44 22.5	-64 15 30	10.92	(0.06)	V	BY	104 106
760767	V560	Car	10 44 33.7	-59 44 15	7.74	(0.02)	V	ELL	108 DM
760768	V561	Car	10 44 59.6	-65 02 19	10.89	(0.09)	V	BY	104 107
760769	V562	Car	10 45 18.6	-63 32 27	14.12	(0.08)	V	BY	104 105
760770	V563	Car	10 45 30.0	-64 25 21	10.66	(0.10)	V	BY	104 107
760771	V564	Car	10 46 14.8	-64 02 58	10.70	(0.12)	V	BY	104 105
760772	V565	Car	10 46 35.3	-64 03 45	12.71	(0.12)	V	BY	104 105
760773	V566	Car	10 46 51.8	-63 34 16	12.97	(0.21)	V	BY	104 105
760774	V567	Car	10 48 18.4	-64 09 53	10.26	(0.05)	V	BY	104 107
760775	V568	Car	10 48 25.4	-64 22 44	13.79	(0.07)	V	BY	104 105
760776	V569	Car	10 49 26.4	-64 39 00	13.33	(0.14)	V	BY	104 105
760777	V570	Car	10 49 48.4	-64 46 29	11.73	(0.10)	V	BY	104 105
760778	V571	Car	10 49 56.8	-63 48 19	12.94	(0.11)	V	BY	104 105
760779	KT	UMa	10 58 07.4	+56 07 09	11.07	11.57	V	RRAB	109 110
760780	WX	Crt	11 01 23.8	-11 32 44	12.3	14.3	V	SR:	111 GSC
760781	KU	UMa	11 05 37.2	+58 20 09	14.0	14.8	V	SR:	054 GSC
760782	GK	Leo	11 07 50.5	+27 09 08	11.6	13.2	V	LB	054 GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	Ref.
760783	KV	UMa	11 18 10.9 +48 02 13	12.8	18.8	V	XND	112 113
760784	V1033	Cen	11 41 22.7 -64 10 16	16.6	(1.0)	V	XM	114 005
760785	GL	Leo	11 45 57.1 +23 17 30	18.6	(0.04)	I	BY	115 262
760786	KW	UMa	11 47 07.8 +61 24 07	6.83	(0.03)	B	DSCTC	009 DM
760787	EE	Cha	11 58 35.2 -77 49 32	7.04	7.15	B	DSCT	116 DM
760788	KX	UMa	11 58 43.3 +63 21 15	13.3	14.6	V	SRA:	012 GSC
760789	DX	Cru	12 05 19.3 -62 03 46	14.45	14.61	y	GDOR:	117 117
760790	EF	Cha	12 07 05.5 -78 44 28	7.86	7.97	B	DSCT	116 DM
760791	KY	UMa	12 21 29.1 +53 04 37	12.4	(0.05*)	B	RPHS	094 095
760792	LM	Com	12 26 30.8 +30 38 52	16.00	16.22	Rc	R	118 095
760793	DF	CVn	12 43 37.2 +38 44 16	10.96	11.46	V	EW	119 120
760794	DY	Cru	12 47 24.7 -59 41 41	8.4	9.9	V	SR	121 GSC
760795	KU	Dra	13 01 53.5 +65 54 08	11.8	13.3	V	RR:	012 GSC
760796	OP	Vir	13 03 27.6 +04 54 29	8.30	8.64	V	SRB	122 DM
760797	LN	Com	13 11 02.6 +18 03 54	14.0	14.7	V	SR:	012 GSC
760798	OQ	Vir	13 25 43.3 +06 03 17	12.3	14.3	V	SR:	054 GSC
760799	DG	CVn	13 31 46.6 +29 16 37	13.52	(0.1)	B	UV+BY:	123 123
760800	OR	Vir	13 32 13.3 -19 39 51	12.4	14.4	V	SR:	054 GSC
760801	OS	Vir	13 40 41.8 +07 05 12	15.5	16.51	V	UV	124 124
760802	OT	Vir	14 01 07.8 -00 47 45	14.1	(15.5	V	M:	012 GSC
760803	FT	Boo	14 13 59.6 +47 26 43	12.9	15.1	V	L:	012 GSC
760804	FU	Boo	14 22 53.8 +19 32 19	13.5	15.0	V	LB:	054 GSC
760805	OU	Vir	14 35 00.2 -00 46 06	14.5	18.5	V	UGSU+E	125 005
760806	V1034	Cen	14 35 01.3 -60 23 32	9.14	(0.03)	B	DSCTC	009 DM
760807	V1035	Cen	14 35 21.5 -62 22 40	9.18	(0.02)	B	DSCTC	009 DM
760808	V1036	Cen	14 36 39.7 -62 33 42	10.03	(0.02)	B	DSCTC	009 DM
760809	OV	Vir	14 41 30.2 -02 02 28	7.83	(0.03v)	V	DSCTC:	126 DM
760810	KL	Lib	14 48 34.9 -01 07 03	8.79	(0.02v)	V	DSCTC	263 DM
760811	KV	Dra	14 50 38.3 +64 03 29	11.8	17.1	V	UGSU	127 USNO
760812	V1037	Cen	14 56 50.5 -30 05 34	12.0	14.9	V	M	054 GSC
760813	V1038	Cen	15 02 51.7 -41 36 03	12.7	(14.8	V	M	128 GSC
760814	KM	Lib	15 08 18.8 -03 09 48	12.8	13.8	V	SR:	012 GSC
760815	FV	Boo	15 08 25.8 +09 36 19	12.0	15.1	V	M	012 264
760816	V344	Ser	15 11 58.8 +06 02 20	13.0	14.4	V	L	012 GSC
760817	V345	Ser	15 16 21.9 +11 30 02	13.9	14.9	V	SR:	012 GSC
760818	V346	Ser	15 18 40.3 +14 59 03	11.9	14.0	V	SRA	012 GSC
760819	V347	Ser	15 27 23.6 +04 28 28	12.9	15.0	V	SR:	012 GSC
760820	FW	Boo	15 29 25.8 +52 25 09	11.4	14.3	V	SR:	012 GSC
760821	KN	Lib	15 29 56.4 -12 53 02	12.9	(0.60)	V	RRC	129 129
760822	KO	Lib	15 30 36.0 -21 45 43	13.5	14.0	V	I:	012 GSC
760823	KW	Dra	15 31 19.7 +52 44 33	10.9	11.9	V	SR:	012 GSC
760824	KP	Lib	15 39 22.3 -12 06 54	13.6	(0.6)	V	RRC	130 GSC
760825	FX	Boo	15 41 07.5 +47 20 44	12.2	(15.1	V	M:	012 USNO
760826	KX	Dra	15 41 44.8 +64 53 56	15.7	(0.32)	B	ZZA	131 095
760827	V381	Nor	15 50 58.7 -56 28 36	15.6	(21.4	V	XND	132 133
760828	V1143	Sco	15 51 22.9 -21 43 07	12.8	14.2	V	SR:	012 GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s ° ' "	Max m	Min m			Type	Ref.	
760829	AK	CrB	15 56 01.5 +37 06 22	11.2	12.4		V	SR:	012	GSC
760830	V1144	Sco	15 56 29.4 -23 48 19	13.01	(0.09	)	V	BY	134	135
760831	NR	Lup	15 56 33.6 -33 18 24	12.0	12.9		V	SR:	012	DM
760832	NS	Lup	15 56 41.3 -33 16 43	13.7	(15.2		V	SR:	012	GSC
760833	V1145	Sco	15 56 55.0 -23 29 47	15.45	(0.13	)	V	BY	134	135
760834	V1146	Sco	15 57 20.1 -23 38 49	12.78	(0.06	)	V	BY	134	135
760835	V1147	Sco	15 57 25.8 -23 54 22	13.72	(0.15	)	V	BY:	134	135
760836	V1148	Sco	15 57 34.3 -23 21 11	13.62	(0.28	)	V	BY	134	135
760837	V1149	Sco	15 58 36.9 -22 57 15	10.10	10.25		V	INT	136	DM
760838	V1150	Sco	15 59 60.0 -22 20 37	13.25	(0.27	)	V	BY:	134	135
760839	delta	Sco	16 00 20.0 -22 37 18	1.86	2.32		V	GCAS	137	DM
760840	V1151	Sco	16 01 05.2 -22 27 31	13.74	(0.16	)	V	BY	134	135
760841	V1152	Sco	16 01 25.7 -22 40 40	11.45	(0.14	)	V	BY	134	135
760842	V1153	Sco	16 02 08.5 -22 54 59	14.09	(0.07	)	V	BY	134	135
760843	V1154	Sco	16 02 10.5 -22 41 29	11.32	(0.13	)	V	RS:	134	135
760844	V1155	Sco	16 03 53.7 -26 48 37	13.1	(14.7		V	M:	138	USNO
760845	V1156	Sco	16 04 47.7 -19 30 23	11.16	(0.17	)	V	BY	134	135
760846	V1012	Her	16 05 28.9 +42 10 30	12.4	(15.2		V	M	012	GSC
760847	V1157	Sco	16 11 20.6 -18 20 54	12.45	(0.16	)	V	BY	134	135
760848	V1158	Sco	16 14 21.1 -18 41 11	13.3	(15.2		V	M:	012	USNO
760849	V1159	Sco	16 18 58.6 -23 16 30	12.60	13.40		V	INT:	136	GSC
760850	V1160	Sco	16 20 52.1 -31 53 24	11.3	(14.7		V	M	012	USNO
760851	V1013	Her	16 24 49.7 +08 04 14	12.6	13.6		*	RRAB	140	GSC
760852	V2503	Oph	16 25 10.5 -23 19 14	13.39	13.66		V	INT	136	265
760853	V2504	Oph	16 25 51.8 -08 59 48	13.0	13.6		V	EW:	012	GSC
760854	V2505	Oph	16 29 48.7 -21 52 12	11.23	(0.13	)	V	BY	134	135
760855	V1161	Sco	16 32 46.0 -39 45 49	10.1	(13.9		V	M	141	
760856	V2506	Oph	16 45 47.7 -02 13 03	12.3	13.1		V	LB:	012	GSC
760857	V1162	Sco	16 46 01.3 -36 33 07	12.5	(14.3		V	M:	142	USNO
760858	V2507	Oph	16 48 18.0 -14 11 15	13.49	13.66		V	INT	136	143
760859	V2508	Oph	16 48 45.6 -14 16 35	13.19	13.40		V	INT	136	143
760860	V2509	Oph	16 51 29.9 +06 22 27	12.7	13.4		*	RRAB	140	GSC
760861	V2510	Oph	16 53 28.3 -20 27 48	13.5	(15.2		V	M:	144	USNO
760862	V2511	Oph	16 56 25.1 -20 30 44	13.1	(15.5		V	M:	145	USNO
760863	V2512	Oph	16 57 12.8 -12 51 23	11.1	12.0		*	SR:	146	USNO
760864	V2513	Oph	16 58 24.0 -20 23 36	11.1	12.1		*	SR:	057	USNO
760865	V2514	Oph	16 58 46.7 -12 43 47	11.2	(14.2		*	M	146	GSC
760866	V2515	Oph	16 59 13.1 -11 20 22	11.8	13.9		*	SR:	147	GSC
760867	V1014	Her	16 59 25.1 +23 06 20	10.8	12.7		V	SR:	012	GSC
760868	V2516	Oph	17 00 22.5 -30 01 33	12.5	15.2		*	M:	057	USNO
760869	V2517	Oph	17 00 52.2 -29 01 34	12.4	(14.0		*	SR:	057	USNO
760870	V2518	Oph	17 01 00.9 -22 49 47	11.5	13.9		*	M:	057	USNO
760871	V2519	Oph	17 02 57.5 -28 57 18	11.3	12.3		*	SR:	057	USNO
760872	V2520	Oph	17 02 58.9 -28 57 16	11.2	12.1		*	SR:	057	USNO
760873	V2521	Oph	17 03 07.0 -20 33 26	8.8	10.0		*	SR:	057	USNO
760874	V2522	Oph	17 08 11.4 -27 52 60	12.0	17.7		R	M:	148	148

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s	o ' "	Max m	Min m			Type	Ref.	
760875	V2523	Oph	17 08 36.6	-17 26 31	10.9	12.94		V	ZAND	149	GSC
760876	V2524	Oph	17 11 49.8	-26 39 12	12.9	16.8		R	M:	148	148
760877	V2525	Oph	17 15 05.3	-09 23 50	11.9	(15.1		V	M	150	USNO
760878	V877	Ara	17 16 58.9	-65 32 59	13.5	(15.5		P	UG	151	152
760879	V2526	Oph	17 19 52.3	-24 55 17	14.5	18.	:	R	M:	148	148
760880	V2527	Oph	17 22 04.2	-19 49 08	14.4	19.		*	UGSU	153	005
760881	V348	Ser	17 25 59.5	-14 03 13	13.0	(14.3		V	M:	154	USNO
760882	V2528	Oph	17 27 58.3	-22 30 03	12.7	(14.7		V	SR:	054	USNO
760883	V2529	Oph	17 29 56.4	-17 40 40	12.4	(14.6		V	M:	155	GSC
760884	V349	Ser	17 30 20.0	-10 18 57	11.9	(15.1		V	M	156	USNO
760885	V2530	Oph	17 31 34.6	+08 09 13	13.5	(0.40	)	V	RRC:	157	158
760886	V1163	Sco	17 33 37.0	-36 15 35	9.9	12.4		V	M	054	
760887	V2531	Oph	17 36 04.1	-19 43 11	12.7	(13.6		V	M:	159	GSC
760888	V1164	Sco	17 36 15.3	-44 44 07	14.63	15.42		V	RRAB	160	160
760889	V2532	Oph	17 37 34.1	-17 47 14	12.4	(13.3		V	M:	161	USNO
760890	V4644	Sgr	17 46 14.4	-28 50 03	8.2	9.2		K	M	162	162
760891	V4645	Sgr	17 46 14.9	-28 48 43	9.6	11.3		K	M	162	162
760892	V4646	Sgr	17 46 15.2	-28 49 28	8.0	9.6		K	M	162	162
760893	V4647	Sgr	17 46 15.3	-28 50 04	7.1	7.6		K	SDOR	162	267
760894	V4648	Sgr	17 46 15.6	-28 50 24	9.6	10.5		K	M	162	162
760895	V4649	Sgr	17 46 17.4	-28 50 14	7.9	8.6		K	M	162	162
760896	V4650	Sgr	17 46 18.0	-28 49 03	7.0	7.9		K	SDOR	162	267
760897	V1165	Sco	17 49 50.0	-37 05 05	15.8	17.0		V	RRAB	163	163
760898	V1166	Sco	17 50 01.3	-37 06 26	15.6	16.0		V	RRC:	163	163
760899	V1167	Sco	17 50 18.8	-37 05 49	17.8	18.4		V	EW	163	163
760900	V1168	Sco	17 50 18.9	-37 08 09	16.2	17.7		V	EA	163	163
760901	V1169	Sco	17 50 34.5	-37 01 32	16.5	16.9		V	EA:	163	163
760902	V1170	Sco	17 50 41.5	-37 04 13	15.2	15.55	:	V	EW	163	163
760903	V4651	Sgr	17 51 41.2	-17 36 07	14.2	15.3		*	LB	072	USNO
760904	V1015	Her	17 52 24.1	+34 11 12	13.8	17.5		B	M	164	164
760905	V4652	Sgr	17 52 26.6	-17 39 58	13.9	16.9		*	M	072	057
760906	V4653	Sgr	17 53 02.1	-17 35 35	12.2	14.2		*	SR:	057	057
760907	V4654	Sgr	17 53 13.6	-17 28 44	12.1	14.8		*	M:	072	057
760908	V1171	Sco	17 54 23.5	-30 57 52	14.1	15.3		*	SR:	072	USNO
760909	V4655	Sgr	17 54 34.2	-19 44 08	11.5	13.0		*	SR:	057	057
760910	V4643	Sgr	17 54 40.4	-26 14 15	8.1	16.		V	NA	275	USNO
760911	V1172	Sco	17 54 47.6	-31 01 26	12.3	14.3		*	SR:	072	057
760912	V1173	Sco	17 54 53.2	-30 57 34	13.5	14.8		*	SR:	072	USNO
760913	V4642	Sgr	17 55 09.8	-19 46 01	10.4	(19.		V	NA	166	165
760914	V1174	Sco	17 55 12.1	-31 01 14	11.7	13.7		*	SR:	072	057
760915	V1175	Sco	17 55 33.0	-30 46 33	13.3	15.8		*	M:	072	USNO
760916	V1176	Sco	17 56 40.0	-30 04 26	11.8	12.6		*	SR:	057	USNO
760917	V4656	Sgr	17 56 55.6	-29 31 17	12.6	(15.0		*	LB:	057	USNO
760918	V350	Ser	17 57 02.0	-14 23 10	11.6	12.8		*	SR:	197	USNO
760919	V351	Ser	17 57 11.9	-00 28 43	13.3	14.1		*	SRA	057	USNO
760920	V4657	Sgr	17 57 15.7	-18 12 57	13.6	(16.3		*	M:	057	USNO

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 o ' "	Max m	Min m			Type	Ref.	
760921	V1177	Sco	17 57 28.4	-31 15 32	12.4	15.0		*	M:	072	USNO
760922	V352	Ser	17 57 32.8	-10 12 41	14.0	15.1		*	SR:	057	057
760923	V4658	Sgr	17 57 34.1	-28 26 06	12.1	(14.5		*	M:	057	USNO
760924	V4659	Sgr	17 57 37.5	-25 59 43	11.7	13.0		*	SR:	057	057
760925	V353	Ser	17 57 39.6	-02 48 20	13.1	15.0		*	SR:	146	USNO
760926	V4660	Sgr	17 57 40.0	-20 46 25	12.4	13.9		*	SR:	057	057
760927	V4661	Sgr	17 57 41.6	-19 05 42	13.8	(15.9		*	SR:	057	USNO
760928	V4662	Sgr	17 57 43.8	-22 06 18	13.0	(15.5		*	M:	057	057
760929	V354	Ser	17 57 46.4	-10 53 54	12.3	(14.7		*	M:	197	057
760930	V4663	Sgr	17 57 51.3	-24 46 32	12.4	14.1		*	SR:	057	USNO
760931	V4664	Sgr	17 57 53.6	-21 12 04	13.1	14.4		*	SR:	057	USNO
760932	V355	Ser	17 57 57.5	-11 40 41	11.7	14.0		*	M:	057	USNO
760933	V4665	Sgr	17 58 01.3	-29 36 41	12.3	(15.0		*	L:	057	057
760934	V4666	Sgr	17 58 09.5	-30 04 22	13.1	(14.3		*	SR:	057	USNO
760935	V2533	Oph	17 58 13.7	-04 36 47	13.4	14.6		V	SR:	167	GSC
760936	V356	Ser	17 58 22.1	-11 45 13	12.3	15.8		*	M:	057	USNO
760937	V357	Ser	17 58 23.3	-13 36 29	13.0	14.1		*	SR:	057	057
760938	V4667	Sgr	17 58 28.3	-29 37 53	12.0	14.1		*	SR:	057	USNO
760939	V4668	Sgr	17 58 28.9	-27 52 03	12.3	14.6		*	SR:	057	057
760940	V4669	Sgr	17 58 31.4	-31 14 46	11.8	(14.0		*	M:	072	USNO
760941	V358	Ser	17 58 37.5	-15 45 19	12.8	14.8		*	SR:	057	057
760942	V4670	Sgr	17 58 40.7	-28 12 25	9.9	11.9		*	SR:	057	USNO
760943	V4671	Sgr	17 58 42.4	-18 15 06	10.5	12.8		*	M:	269	USNO
760944	V4672	Sgr	17 58 45.9	-29 56 09	11.4	(14.4		*	M:	072	057
760945	V4673	Sgr	17 58 50.9	-20 33 46	12.7	13.7		*	SR:	057	USNO
760946	V359	Ser	17 58 52.3	-10 35 46	13.5	14.7		*	SR:	057	USNO
760947	V360	Ser	17 58 54.4	-14 51 53	12.2	(14.6		*	M:	197	USNO
760948	V4674	Sgr	17 58 58.6	-29 45 33	12.9	14.0		*	SR:	269	USNO
760949	V4675	Sgr	17 59 00.5	-30 22 55	13.9	(16.5		*	M:	057	USNO
760950	V4676	Sgr	17 59 02.6	-20 07 01	13.1	13.9		*	SR:	057	057
760951	V4677	Sgr	17 59 07.8	-27 29 27	11.6	12.8		*	SR:	057	USNO
760952	V361	Ser	17 59 15.9	-12 07 18	13.2	14.4		*	SR:	197	USNO
760953	V4678	Sgr	17 59 17.4	-29 50 46	12.9	14.1		*	SR:	269	057
760954	V4679	Sgr	17 59 18.3	-20 52 37	11.7	13.9		*	SR:	269	USNO
760955	V4680	Sgr	17 59 21.0	-16 48 32	13.6	15.2		*	SR:	269	057
760956	V2534	Oph	17 59 29.5	-09 44 16	13.2	14.3		*	SR:	147	USNO
760957	V4681	Sgr	17 59 34.1	-21 19 41	12.2	13.3		*	SR:	057	USNO
760958	V4682	Sgr	17 59 37.3	-29 38 30	11.6	13.2		*	SR:	072	057
760959	V362	Ser	17 59 38.8	-15 57 58	12.9	14.4		*	SR:	197	057
760960	V4683	Sgr	17 59 39.6	-25 13 30	10.8	19.	B :	*	M	168	USNO
760961	V4684	Sgr	17 59 40.4	-29 37 57	12.5	13.6		*	SR:	072	USNO
760962	V4685	Sgr	17 59 47.5	-25 12 32	13.2	14.5		*	E:	057	057
760963	V4686	Sgr	17 59 48.2	-31 22 48	12.9	14.8		*	SR:	072	USNO
760964	V4687	Sgr	17 59 56.1	-24 54 19	13.1	14.1		*	SR:	057	057
760965	V4688	Sgr	17 59 56.9	-24 51 38	12.3	14.8		*	M:	057	057
760966	V4689	Sgr	17 59 59.5	-28 03 23	12.0	13.6		*	SR:	057	USNO

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s	o ' "	Max m	Min m		Type	Ref.	
760967	V4690	Sgr	17 59 60.0	-29 34 23	12.7	13.8	*	SR:	072	USNO
760968	V4691	Sgr	18 00 04.5	-29 50 09	12.7	14.7	*	SR:	072	057
760969	V4692	Sgr	18 00 09.5	-27 47 42	12.2	14.1	*	SR:	269	USNO
760970	V4693	Sgr	18 00 20.3	-29 42 58	13.3	14.4	*	SR:	072	057
760971	V363	Ser	18 00 20.6	-14 30 42	13.8	(15.2	*	SR:	057	USNO
760972	V4694	Sgr	18 00 30.4	-27 23 42	12.1	13.9	*	SR:	057	057
760973	V4695	Sgr	18 00 41.3	-29 37 37	11.7	12.6	*	SR:	057	USNO
760974	V4696	Sgr	18 00 44.1	-29 53 15	12.9	15.0	*	SR:	072	USNO
760975	V4697	Sgr	18 00 44.7	-30 13 12	13.2	14.3	*	SR:	057	057
760976	V364	Ser	18 00 53.0	-10 32 36	12.3	14.6	*	SR:	146	USNO
760977	V4698	Sgr	18 00 53.1	-31 28 52	12.3	15.2	*	M:	057	USNO
760978	V365	Ser	18 00 55.0	-14 38 29	12.3	14.2	*	SR:	197	057
760979	V4699	Sgr	18 01 02.2	-23 40 51	13.1	14.0	*	SR:	269	057
760980	V4700	Sgr	18 01 02.5	-31 14 26	12.5	15.4	*	M:	072	USNO
760981	V4701	Sgr	18 01 09.9	-30 03 31	11.1	14.4	*	M:	057	057
760982	V4702	Sgr	18 01 10.3	-27 08 48	12.6	(14.5	*	SR:	057	USNO
760983	V4703	Sgr	18 01 11.1	-18 00 27	14.7	(16.5	*	M:	269	USNO
760984	V4704	Sgr	18 01 25.5	-18 51 56	14.0	(15.4	*	SR:	057	USNO
760985	V366	Ser	18 01 25.9	-14 56 31	13.2	(14.6	*	SR:	197	USNO
760986	V4705	Sgr	18 01 26.9	-29 36 57	13.1	14.5	*	SR:	057	USNO
760987	V4706	Sgr	18 01 30.5	-27 57 02	11.9	12.7	*	SR:	057	GSC
760988	V4707	Sgr	18 01 45.3	-30 05 03	13.1	(14.4	*	SR:	072	USNO
760989	V4708	Sgr	18 01 45.5	-29 46 12	12.6	13.6	*	SR:	057	USNO
760990	V4709	Sgr	18 01 56.2	-17 06 42	13.2	(14.3	*	SR:	269	057
760991	V367	Ser	18 02 05.8	-10 39 39	13.5	16.1	*	M:	057	057
760992	V4710	Sgr	18 02 19.7	-27 42 02	11.9	12.8	*	SR:	057	057
760993	V4711	Sgr	18 02 23.3	-29 45 22	13.3	(14.4	*	SR:	057	USNO
760994	V4712	Sgr	18 02 25.3	-27 50 37	10.8	12.5	*	SR:	057	USNO
760995	V4713	Sgr	18 02 29.5	-30 24 14	11.9	14.5	*	M:	057	USNO
760996	V4714	Sgr	18 02 30.5	-24 51 27	11.2	12.5	*	SR:	269	057
760997	V4715	Sgr	18 02 33.9	-31 25 20	12.2	14.3	*	SR:	072	057
760998	V368	Ser	18 02 43.6	-02 52 45	13.9	14.8	*	SR:	146	057
760999	V369	Ser	18 02 48.6	-15 41 25	13.0	(14.4	*	SR:	269	057
761000	V4716	Sgr	18 02 48.6	-21 17 20	13.3	14.0	*	SR:	269	USNO
761001	V4717	Sgr	18 03 02.6	-31 09 15	12.7	(14.0	*	SR:	057	057
761002	V4718	Sgr	18 03 11.7	-27 39 31	12.6	(14.4	*	SR:	057	057
761003	V4719	Sgr	18 05 29.2	-27 48 22	12.7	14.2	*	SR:	072	USNO
761004	V722	CrA	18 06 13.6	-40 15 07	12.3	(13.0	V	SR:	054	GSC
761005	V2535	Oph	18 07 29.2	+06 22 37	12.8	13.1	*	SR	169	USNO
761006	V4720	Sgr	18 07 57.7	-27 15 52	12.5	14.5	*	SR:	057	USNO
761007	V4721	Sgr	18 08 11.4	-27 14 08	12.9	14.6	*	SR:	057	USNO
761008	V2536	Oph	18 09 57.3	+08 50 26	11.55	12.08	*	EA	170	GSC
761009	V4722	Sgr	18 10 44.4	-26 09 00	21.5	(22.5	B	XB	171	171
761010	V4723	Sgr	18 11 47.0	-29 20 24	11.9	(13.1	V	M	172	
761011	V4724	Sgr	18 11 57.8	-18 52 12	11.1	(13.2	V	M:	173	USNO
761012	V4725	Sgr	18 13 25.9	-28 56 51	10.9	11.8	V	SR	174	GSC

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	Ref.	
761013	V1016	Her	18 16 58.2 +15 59 19	11.0	15.0	V	M	012	GSC
761014	V2537	Oph	18 21 13.5 +00 27 23	12.5	(15.1	V	M:	175	USNO
761015	V1017	Her	18 21 26.1 +18 10 26	10.29	10.47	V	EA	176	DM
761016	V464	Sct	18 25 00.9 -06 50 57	13.3	(15.2	V	M	177	GSC
761017	V4726	Sgr	18 26 19.2 -29 28 14	12.1	(13.4	V	M	178	GSC
761018	V1018	Her	18 29 46.4 +14 07 46	10.5	11.6	V	SR	179	GSC
761019	V370	Ser	18 29 49.1 +01 16 31	16.3	17.3	H	INT	180	271
761020	V371	Ser	18 29 51.1 +01 16 39	10.2	12.2	K	INT	271	271
761021	V562	Lyr	18 31 13.9 +46 58 35	11.8	16.8	P	ZAND:	181	GSC
761022	V2538	Oph	18 32 06.9 +08 07 12	12.1	12.5	*	SR:	066	GSC
761023	V4727	Sgr	18 33 30.7 -28 58 51	10.6	(13.8	V	E	182	DM
761024	V463	Sct	18 34 03.2 -14 45 12	10.6	(18.	V	NA	183	184
761025	V2539	Oph	18 35 06.1 +08 14 28	12.2	12.4	*	SR:	169	USNO
761026	V723	CrA	18 38 21.4 -38 53 56	12.1	12.8	V	SR:	054	GSC
761027	V724	CrA	18 39 22.8 -38 25 25	10.0	11.0	V	SR:	054	GSC
761028	V465	Sct	18 40 22.6 -15 34 13	12.1	(12.9	V	SR:	185	GSC
761029	V725	CrA	18 40 27.2 -38 19 30	12.1	12.8	V	SR:	054	GSC
761030	V4728	Sgr	18 41 37.0 -27 57 01	9.00	9.28	V	SRD	084	DM
761031	V726	CrA	18 44 30.8 -43 41 09	11.0	(14.3	V	M	186	187
761032	V563	Lyr	18 45 06.6 +40 11 12	10.96	11.47	V	EW	188	DM
761033	V1019	Her	18 45 43.7 +16 01 57	11.2	12.8	V	LB:	012	GSC
761034	V1495	Aql	18 53 17.8 -00 06 28	14.0	15.0	P	DCEP	189	189
761035	V1496	Aql	18 54 59.5 -00 04 36	12.5	13.4	P	DCEP:	189	189
761036	V349	Sge	18 57 26.5 +19 48 47	10.5	12.6	*	SR:	146	GSC
761037	V1497	Aql	18 57 26.7 -03 34 34	11.8	13.5	*	SR:	057	USNO
761038	V4729	Sgr	18 57 32.8 -18 55 17	13.8	15.2	*	SR:	197	USNO
761039	V1498	Aql	18 57 35.9 +10 09 02	13.8	15.5	*	SR:	057	057
761040	V1020	Her	18 57 43.5 +13 37 16	13.6	15.5	*	SR:	057	057
761041	V1499	Aql	18 57 51.1 -01 59 00	10.7	11.6	*	SR	190	USNO
761042	V727	CrA	18 58 03.9 -43 50 32	12.7	(14.7	V	M:	191	GSC
761043	V1500	Aql	18 58 10.3 -05 44 59	12.3	13.3	*	SR:	192	USNO
761044	KY	Dra	18 58 15.7 +63 48 58	12.1	12.8	V	SR:	012	GSC
761045	V466	Sct	18 58 34.5 -04 04 51	13.7	14.4	*	SR:	190	057
761046	V1501	Aql	18 58 39.6 -03 58 17	13.2	15.8	*	M:	057	USNO
761047	V406	Vul	18 58 41.5 +22 39 30	15.33	(24.	V	XND	193	194
761048	V1502	Aql	18 58 52.6 -09 41 07	11.5	12.9	*	SR:	195	057
761049	V1503	Aql	18 59 01.3 -03 23 07	12.5	13.8	*	SR:	147	057
761050	V1504	Aql	18 59 01.4 +10 42 21	14.0	(16.0	*	M:	057	057
761051	V4730	Sgr	18 59 01.4 -16 51 58	11.3	12.6	*	SR:	057	GSC
761052	V467	Sct	18 59 05.4 -15 15 48	11.7	14.8	*	M:	057	USNO
761053	V1505	Aql	18 59 11.1 -01 38 50	13.2	(14.6	*	SR:	192	057
761054	V4731	Sgr	18 59 27.2 -13 51 23	13.2	14.5	*	SR:	197	057
761055	V4732	Sgr	18 59 39.6 -14 26 17	11.13	11.15	V	PVTEL	196	GSC
761056	V1506	Aql	18 59 51.2 +10 08 32	13.1	(15.8	*	M:	057	057
761057	V1507	Aql	18 59 53.8 -03 14 34	10.5	(13.1	*	M:	190	057
761058	V1508	Aql	18 59 55.1 -10 10 59	12.5	13.9	*	SR:	190	USNO

Table 1 (continued)

No.	Name		R.A., 2000.0 (h m s)	Decl., 2000.0 (o ' ")	Max (m)	Min (m)		Type	Ref.	
761059	V350	Sge	19 00 11.6	+20 03 54	12.4	13.1	*	SR:	147	USNO
761060	V1509	Aql	19 00 11.9	-02 57 24	10.8	13.6	*	SR:	197	057
761061	V1510	Aql	19 00 17.7	-06 06 58	11.7	14.5	*	M:	192	USNO
761062	V351	Sge	19 00 17.9	+19 35 40	12.1	13.6	*	SR:	147	USNO
761063	V1511	Aql	19 00 31.8	-02 12 20	13.0	14.8	*	SR	057	USNO
761064	V1512	Aql	19 00 49.5	-01 53 45	12.1	13.3	*	SR	195	USNO
761065	V1513	Aql	19 01 05.0	-03 10 49	11.0	13.2	*	SR:	197	USNO
761066	V1514	Aql	19 01 10.0	-10 03 30	12.5	14.0	*	SR:	072	USNO
761067	V1515	Aql	19 01 15.0	+11 32 39	12.3	13.7	*	SR:	057	057
761068	V1516	Aql	19 01 20.4	-03 30 36	12.9	14.4	*	SR:	057	USNO
761069	V352	Sge	19 01 38.1	+19 03 19	12.0	13.6	*	SR:	057	USNO
761070	V1517	Aql	19 01 39.6	-06 46 23	12.2	14.3	*	SR:	192	USNO
761071	V1518	Aql	19 01 53.2	+10 56 55	13.1	15.1	*	SR:	057	057
761072	V1519	Aql	19 01 53.3	+12 05 33	12.1	13.6	*	SR:	057	057
761073	V1520	Aql	19 01 58.5	-02 00 47	12.5	(0.7)	V	SR	198	GSC
761074	V1521	Aql	19 02 09.5	+16 56 05	12.8	14.3	*	SR	057	USNO
761075	V4733	Sgr	19 02 22.2	-18 25 18	11.9	13.3	*	SR:	057	GSC
761076	V1522	Aql	19 02 25.4	-07 56 50	11.3	13.4	*	SR:	190	USNO
761077	V1523	Aql	19 02 28.4	-01 12 17	13.7	16.0	*	SR:	057	057
761078	V1524	Aql	19 02 36.0	-07 01 34	11.1	13.2	*	SR:	190	GSC
761079	V1525	Aql	19 02 42.9	-01 42 51	12.7	14.5	*	SR:	192	057
761080	V1526	Aql	19 06 05.7	-01 29 59	10.	(12.5	*	M	199	USNO
761081	V1527	Aql	19 08 47.6	-04 02 46	14.1	(1.5 *)	V	M:	200	USNO
761082	V1528	Aql	19 08 53.1	-02 01 18	11.0	(12.0	I	M	198	
761083	V394	Pav	19 09 23.3	-60 07 03	18.43	19.03	V	EW	201	201
761084	V395	Pav	19 09 35.7	-59 49 21	16.88	17.39	V	EW	201	201
761085	V396	Pav	19 09 52.7	-59 58 11	19.10	19.70	V	EW	201	
761086	V4734	Sgr	19 09 59.9	-26 38 25	10.7	14.0	V	M	202	GSC
761087	V1529	Aql	19 11 03.0	+00 39 38	17.3	17.7	I	EW	203	203
761088	V1530	Aql	19 11 05.9	+00 39 06	17.6	18.1	I	EW	203	203
761089	V1531	Aql	19 11 09.2	+00 31 54	15.5	15.7	I	EW	203	203
761090	V397	Pav	19 11 10.8	-59 58 53	17.03	17.51	V	EW	201	201
761091	V1532	Aql	19 11 14.1	+00 34 46	15.2	15.6	I	EW	203	203
761092	V1533	Aql	19 11 17.7	+00 33 35	17.5	18.1	I	EA	203	203
761093	V1534	Aql	19 11 18.3	+00 37 12	16.6	17.1	I	EW	203	203
761094	V1535	Aql	19 11 23.5	+00 36 05	16.2	16.6	I	EW	203	203
761095	V1536	Aql	19 11 24.8	+00 38 20	18.5	19.1	I	EW	203	203
761096	V1537	Aql	19 11 28.8	+00 32 49	16.9	17.7	I	EW	203	203
761097	V398	Pav	19 12 16.3	-59 53 09	15.90	16.23	V	EW	201	201
761098	V4735	Sgr	19 13 38.3	-18 24 34	11.2	(13.8	V	M:	204	USNO
761099	V407	Vul	19 14 26.1	+24 56 44	18.2	(0.06)	I	XM	205	205
761100	V564	Lyr	19 20 39.9	+37 43 55	16.27	16.38	V	FKCOM:	206	206
761101	V565	Lyr	19 20 49.4	+37 46 09	17.73	18.20	V	EA	207	207
761102	V566	Lyr	19 20 52.3	+37 45 51	15.43	15.52	V	BY:	207	207
761103	V567	Lyr	19 20 54.2	+37 45 35	17.38	17.67	V	EA	207	207
761104	V568	Lyr	19 20 57.4	+37 45 37	17.54	17.65	V	EA	207	207

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0		Max	Min		Type	Ref.	
			h m s	o ’ "	m	m				
761105	V1538	Aql	19 24 36.4	+06 31 28	12.3	12.7	*	EW:	272	GSC
761106	V1539	Aql	19 26 34.5	+03 31 52	8.43	(0.03)	V	LBV	208	DM
761107	V1540	Aql	19 28 09.3	+10 29 38	12.4	13.4	*	SR:	057	057
761108	V353	Sge	19 28 37.7	+17 32 36	14.03	14.44	V	CEP:	209	USNO
761109	V2213	Cyg	19 28 57.9	+43 06 26	13.9	(0.47)	R	EW:	210	210
761110	V408	Vul	19 30 27.4	+20 16 04	18.4	18.8	V	EW:	211	211
761111	V354	Sge	19 31 15.5	+19 00 43	15.42	15.80	Ic	CEP	209	
761112	V2214	Cyg	19 32 14.9	+27 58 35	13.82	(0.06)	V	RPHS+ELL	212	036
761113	V355	Sge	19 35 44.8	+18 56 42	14.7	15.6	B	DCEP	213	213
761114	V2215	Cyg	19 37 59.3	+30 53 10	15.59	16.65	V	EA:	214	214
761115	V2216	Cyg	19 38 07.2	+30 52 01	12.29	12.35	V	DSCTC:	214	214
761116	V409	Vul	19 40 13.6	+22 31 34	11.73	12.05	V	BE:	215	GSC
761117	V4736	Sgr	19 42 01.5	-23 10 38	12.4	(15.0	V	M	216	USNO
761118	V1541	Aql	19 42 58.2	-05 13 37	9.52	(13.	*	M	217	USNO
761119	V410	Vul	19 42 59.5	+23 25 34	17.75	18.48	V	CEP	209	USNO
761120	V411	Vul	19 43 07.3	+23 04 33	16.03	16.37	Ic	CEP	209	
761121	V412	Vul	19 45 36.7	+24 12 09	16.22	16.68	V	CEP	209	USNO
761122	V413	Vul	19 46 11.4	+24 09 05	15.30	15.65	V	CEP	209	USNO
761123	V414	Vul	19 46 11.9	+25 00 34	15.01	15.45	Ic	CEP	209	
761124	V1542	Aql	19 46 25.1	+08 45 13	11.71	12.34	*	DSCT:	170	GSC
761125	V415	Vul	19 46 46.9	+24 46 47	13.92	14.23	V	CEP	209	GSC
761126	V2217	Cyg	19 46 55.5	+34 23 35	12.0	(0.15)	Rc	SRA	218	218
761127	V1543	Aql	19 49 15.2	+10 35 43	12.13	12.40	*	SR	169	GSC
761128	V416	Vul	19 50 25.9	+26 51 45	15.93	16.30	Ic	CEP	209	
761129	V417	Vul	19 50 49.3	+26 19 46	16.10	16.46	V	CEP	209	USNO
761130	V1544	Aql	19 54 12.7	+10 39 29	12.2	12.5	*	SR	169	GSC
761131	V2218	Cyg	19 56 57.5	+34 09 53	11.0	14.4	*	M:	192	USNO
761132	V2219	Cyg	19 57 02.6	+34 40 41	14.0	(15.0	*	SR:	057	057
761133	V1545	Aql	19 57 06.6	-07 45 28	10.09	(12.5	*	M	219	GSC
761134	V2220	Cyg	19 57 31.5	+35 46 12	13.6	(16.5	*	M:	057	057
761135	V2221	Cyg	19 57 43.8	+30 46 21	12.4	13.7	*	SR:	192	USNO
761136	V2222	Cyg	19 57 52.6	+30 11 55	12.3	13.4	*	SR:	057	057
761137	V2223	Cyg	19 57 55.1	+31 46 00	10.5	12.0	*	SR:	057	USNO
761138	V2224	Cyg	19 58 06.3	+36 59 10	12.6	(15.0	*	M:	197	057
761139	V2225	Cyg	19 58 08.6	+30 06 29	11.1	12.2	*	SR:	195	057
761140	V2226	Cyg	19 58 32.2	+36 49 40	12.9	(14.8	*	SR:	197	057
761141	V1546	Aql	19 58 55.3	+11 07 03	12.0	12.9	*	SR:	197	GSC
761142	V418	Vul	19 59 41.9	+22 33 50	13.6	(16.0	*	M:	057	USNO
761143	V2227	Cyg	19 59 43.2	+36 52 23	13.0	14.0	*	SR:	147	USNO
761144	V2228	Cyg	19 59 55.8	+29 34 31	11.9	12.5	*	SR:	057	057
761145	V2229	Cyg	20 00 33.8	+29 36 13	13.5	(14.7	*	SR:	057	USNO
761146	V2230	Cyg	20 00 37.6	+32 05 42	12.0	12.9	*	SR:	197	057
761147	V2231	Cyg	20 00 49.5	+34 07 58	13.7	15.8	*	SR:	057	057
761148	V2232	Cyg	20 01 01.4	+30 11 18	17.41	18.02	V	CEP	209	
761149	V2233	Cyg	20 01 16.1	+31 09 50	13.3	14.5	*	SR:	147	USNO
761150	V2234	Cyg	20 01 40.7	+40 11 30	12.3	13.0	*	SR:	057	USNO

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0						Max	Min		Type	Ref.	
			h	m	s	o	’	"	m	m				
761151	V2235	Cyg	20	02	20.4	+37	18	01	13.1	14.6	*	SR:	197	USNO
761152	V2236	Cyg	20	02	44.1	+37	50	59	11.7	12.4	*	SR:	057	USNO
761153	V2237	Cyg	20	02	46.5	+30	41	36	12.8	15.0	*	SR:	057	057
761154	V2238	Cyg	20	06	21.5	+35	54	19	10.54	(0.08)	V	DSCTC	220	220
761155	V1547	Aql	20	09	36.2	+10	39	09	12.63	13.04	*	SR	169	GSC
761156	V419	Vul	20	10	19.5	+29	20	09	11.3	12.3	*	SR:	221	GSC
761157	KZ	Dra	20	11	19.9	+68	33	31	11.2	12.4	V	EA	012	GSC
761158	V2239	Cyg	20	15	17.6	+37	31	44	11.73	12.51	*	EA	222	GSC
761159	V2240	Cyg	20	15	56.0	+37	27	16	12.03	12.29	*	EW	223	GSC
761160	V2241	Cyg	20	16	12.4	+37	41	57	15.0	(0.26)	Ic	EW:	224	224
761161	V2242	Cyg	20	16	31.8	+37	42	32	15.2	15.7	Ic	EW	224	224
761162	V2243	Cyg	20	16	41.6	+37	38	06	15.4	16.0	Ic	EB	224	224
761163	V2244	Cyg	20	16	59.2	+37	37	28	14.22	14.48	Ic	RRC	224	224
761164	V4737	Sgr	20	17	26.4	-30	04	26	12.2	14.4	V	SR:	225	GSC
761165	NV	Del	20	18	13.7	+10	37	55	11.64	11.94	*	SR	169	GSC
761166	V4738	Sgr	20	22	37.5	-39	54	12	18.1	19.2	V	XM	016	016
761167	V2245	Cyg	20	23	10.8	+40	52	30	8.50	(0.04)	V	LBV:	226	DM
761168	V2246	Cyg	20	32	15.2	+37	38	15	9.74	10.34	K	XP	227	228
761169	NW	Del	20	46	53.8	+05	51	27	13.9	(15.0	V	M	054	
761170	V2247	Cyg	20	48	48.0	+34	26	08	10.4	11.3	B	EA	229	GSC
761171	NX	Del	20	50	25.1	+06	05	38	10.0	11.0	V	SRB	054	GSC
761172	V420	Vul	20	59	36.9	+26	28	34	10.3	13.0	V	M	230	230
761173	V2248	Cyg	21	00	14.2	+39	40	23	13.0	15.3	*	SR:	147	057
761174	V2249	Cyg	21	00	37.2	+37	28	55	12.6	14.4	*	SR:	195	USNO
761175	V421	Vul	21	03	10.3	+24	27	07	7.44	7.61	V	SR	122	DM
761176	MO	Aqr	21	03	57.0	-02	10	04	9.95	10.26	V	SRD	231	DM
761177	SZ	Equ	21	04	22.4	+10	28	29	12.1	12.6	*	SR	169	GSC
761178	V422	Vul	21	05	11.0	+26	54	14	11.0	(13.2	V	M	232	USNO
761179	V2250	Cyg	21	10	13.5	+52	51	02	8.9	11.5	I	M	006	011
761180	TT	Equ	21	10	21.1	+10	36	01	12.33	12.84	*	SR	169	GSC
761181	V2251	Cyg	21	14	39.6	+50	23	51	15.11	(0.16)	Rc	EW:	233	233
761182	V535	Cep	21	17	35.0	+65	19	47	12.0	13.0	V	SR:	012	GSC
761183	V536	Cep	21	19	07.2	+65	31	13	11.2	11.7	V	SR:	012	GSC
761184	V537	Cep	21	20	24.0	+64	41	53	12.4	13.4	V	SR:	012	GSC
761185	V538	Cep	21	21	29.3	+63	42	20	13.3	14.2	V	SR:	012	GSC
761186	V539	Cep	21	22	35.7	+61	29	10	12.3	12.9	V	SR:	012	GSC
761187	V540	Cep	21	23	23.8	+60	17	28	12.7	13.7	V	SR:	012	GSC
761188	V541	Cep	21	23	36.2	+61	58	57	10.7	11.4	V	SR:	012	GSC
761189	TU	Equ	21	23	49.3	+06	26	11	11.7	12.3	V	SR:	054	GSC
761190	V542	Cep	21	24	39.2	+59	43	04	13.0	14.3	V	SR:	012	GSC
761191	V543	Cep	21	27	02.2	+56	59	55	10.9	11.5	V	SR:	012	GSC
761192	V544	Cep	21	27	11.6	+58	13	40	14.2	14.9	V	SR:	012	GSC
761193	V545	Cep	21	28	05.8	+66	20	26	11.8	12.6	V	SR:	012	GSC
761194	V546	Cep	21	28	32.1	+61	50	51	13.0	14.3	V	SR:	012	GSC
761195	V547	Cep	21	28	47.5	+58	53	29	12.1	12.6	V	SR:	012	GSC
761196	V548	Cep	21	29	00.1	+65	39	21	14.2	14.7	V	SR:	012	GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0	Max	Min		Type	Ref.	
			h m s o ' "	m	m				
761197	V549	Cep	21 30 01.0 +61 41 37	13.1	13.8	V	SR:	012	GSC
761198	V550	Cep	21 30 15.8 +58 17 39	12.0	12.6	V	SR:	012	GSC
761199	V551	Cep	21 30 43.9 +58 46 48	12.0	12.6	V	SR:	012	GSC
761200	V552	Cep	21 31 00.4 +58 39 15	13.2	13.8	V	SR:	012	GSC
761201	V553	Cep	21 31 03.5 +67 53 33	11.9	12.4	V	SR:	012	GSC
761202	V554	Cep	21 32 01.6 +65 21 18	13.5	14.1	V	SR:	012	GSC
761203	V555	Cep	21 32 02.9 +65 09 46	13.1	13.8	V	SR:	012	GSC
761204	V556	Cep	21 32 43.0 +60 42 53	12.5	13.6	V	SR:	054	GSC
761205	V2252	Cyg	21 32 48.6 +54 40 15	13.7	14.5	V	SR:	054	GSC
761206	V2253	Cyg	21 32 50.3 +39 22 09	14.1	(18.6	B	M	234	234
761207	V557	Cep	21 33 23.1 +56 44 46	13.9	14.5	V	SR:	012	GSC
761208	V558	Cep	21 34 08.7 +61 14 23	13.7	14.5	V	SR:	054	GSC
761209	V559	Cep	21 35 08.0 +62 52 26	12.7	14.1	V	SR:	012	GSC
761210	V2254	Cyg	21 35 08.9 +55 06 40	12.6	13.3	V	SR:	054	GSC
761211	V560	Cep	21 36 10.4 +55 41 11	11.8	12.4	V	SR:	012	GSC
761212	V2255	Cyg	21 36 28.5 +55 15 34	12.9	13.5	V	SR:	054	GSC
761213	V2256	Cyg	21 36 53.9 +33 43 07	8.07	8.17	Hp	ELL	235	DM
761214	V371	Peg	21 36 54.3 +13 40 32	12.1	13.6	V	SR:	012	GSC
761215	V561	Cep	21 36 57.8 +56 57 36	12.2	12.8	V	SR:	012	GSC
761216	V2257	Cyg	21 37 03.0 +54 55 41	12.5	13.0	V	SR:	054	GSC
761217	V562	Cep	21 37 11.1 +61 04 56	12.8	13.6	V	SR:	054	GSC
761218	V563	Cep	21 37 23.1 +63 11 20	12.7	14.2	V	SR:	012	GSC
761219	V564	Cep	21 38 33.3 +69 18 40	10.7	11.4	V	SR:	012	GSC
761220	V565	Cep	21 38 59.9 +61 46 12	13.8	14.3	V	SR:	012	GSC
761221	V566	Cep	21 39 10.4 +68 16 12	12.5	13.0	V	SR:	012	GSC
761222	V567	Cep	21 39 25.6 +67 58 24	12.0	13.4	V	SR:	012	GSC
761223	CF	Ind	21 39 40.8 -51 34 22	7.76	7.81	Hp	DSCTC	009	DM
761224	V568	Cep	21 39 46.3 +57 39 36	11.6	12.2	V	SR:	012	GSC
761225	V2258	Cyg	21 39 58.3 +54 38 60	11.2	12.3	V	SR:	054	GSC
761226	V569	Cep	21 40 04.7 +55 50 55	11.6	12.5	V	SR:	012	GSC
761227	V570	Cep	21 40 25.0 +60 50 43	12.3	12.8	V	SR:	054	GSC
761228	V571	Cep	21 40 50.0 +55 47 58	11.8	12.8	V	SR:	012	GSC
761229	V572	Cep	21 40 53.9 +62 05 04	13.0	13.5	V	SR:	012	GSC
761230	V573	Cep	21 41 16.6 +66 40 54	14.3	14.9	V	SR:	012	GSC
761231	V574	Cep	21 41 32.3 +67 52 47	11.7	12.3	V	SR:	012	GSC
761232	V575	Cep	21 41 49.0 +58 37 07	13.2	14.0	V	SR:	012	GSC
761233	V576	Cep	21 42 03.8 +56 54 25	13.1	13.6	V	SR:	012	GSC
761234	V2259	Cyg	21 42 08.8 +54 58 03	13.1	13.6	V	SR:	054	273
761235	V577	Cep	21 42 43.3 +61 45 35	12.8	13.6	V	SR:	012	GSC
761236	V2260	Cyg	21 43 01.0 +54 56 04	13.1	13.8	V	SR:	054	GSC
761237	V578	Cep	21 43 45.7 +67 53 12	11.4	12.0	V	SR:	012	GSC
761238	V2261	Cyg	21 43 55.2 +53 43 43	13.35	(0.39*)	V	EA	236	236
761239	V2262	Cyg	21 43 56.1 +53 42 43	10.93	(0.13*)	V	IB:	236	236
761240	V2263	Cyg	21 44 03.5 +53 42 47	12.36	(0.68*)	V	EB/SD	236	236
761241	V2264	Cyg	21 44 11.4 +53 44 19	15.24	(0.23*)	V	ACV:	236	236
761242	V579	Cep	21 44 42.2 +67 49 29	11.9	13.0	V	SR:	012	GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	Ref.
761243	V580	Cep	21 44 43.7 +63 21 32	12.0	13.2	V	SR:	012 GSC
761244	V581	Cep	21 45 10.9 +57 48 04	12.7	13.4	V	SR:	012 GSC
761245	V582	Cep	21 45 28.4 +66 00 17	11.8	12.4	V	SR:	012 GSC
761246	V583	Cep	21 45 49.8 +68 15 24	10.3	11.1	V	SR:	012 GSC
761247	V584	Cep	21 45 51.3 +63 49 17	12.8	13.6	V	SR:	012 GSC
761248	V585	Cep	21 45 52.5 +63 35 10	12.9	13.5	V	SR:	012 GSC
761249	V586	Cep	21 45 53.2 +62 00 16	12.0	12.9	V	SR:	012 GSC
761250	V587	Cep	21 45 54.9 +59 16 25	12.3	12.9	V	SR:	012 GSC
761251	V588	Cep	21 46 29.4 +59 01 20	13.3	14.3	V	SR:	012 GSC
761252	V589	Cep	21 46 56.3 +61 26 17	12.8	13.6	V	SR:	012 GSC
761253	V590	Cep	21 46 57.1 +59 34 48	13.6	14.2	V	SR:	012 GSC
761254	V2265	Cyg	21 46 57.6 +54 54 09	11.4	12.3	V	SR:	054 GSC
761255	V372	Peg	21 47 04.8 +17 11 39	6.53	(0.07)	B	GDOR	237 DM
761256	V591	Cep	21 48 22.4 +68 52 10	10.7	11.3	V	SR:	012 GSC
761257	V2266	Cyg	21 48 24.9 +55 22 13	13.9	14.5	V	SR:	054 GSC
761258	V592	Cep	21 49 40.8 +64 49 30	11.8	12.3	V	SR:	012 GSC
761259	V593	Cep	21 49 51.1 +56 02 56	13.0	13.8	V	SR:	012 GSC
761260	V373	Peg	21 50 08.7 +17 17 09	5.17	5.53	V	UV:	238 DM
761261	V594	Cep	21 50 10.3 +55 54 56	12.3	13.0	V	SR:	012 GSC
761262	V595	Cep	21 50 31.3 +69 17 46	13.5	14.5	V	SR:	012 GSC
761263	V596	Cep	21 51 13.2 +66 17 45	12.4	14.0	V	SR:	012 GSC
761264	V597	Cep	21 51 42.3 +61 02 35	11.9	12.5	V	SR:	012 GSC
761265	V598	Cep	21 52 21.9 +67 18 09	13.6	14.3	V	SR:	012 GSC
761266	V2267	Cyg	21 52 44.9 +55 17 37	12.3	12.8	V	SR:	054 GSC
761267	V599	Cep	21 53 04.9 +65 02 11	14.3	14.9	V	SR:	012 GSC
761268	V600	Cep	21 53 41.3 +59 17 33	11.83	(0.6)	V	SR:	054 GSC
761269	V601	Cep	21 54 28.7 +56 50 56	10.9	11.8	V	SR:	012 GSC
761270	V602	Cep	21 54 36.5 +66 45 24	13.6	14.3	V	SR:	012 GSC
761271	V2268	Cyg	21 54 49.2 +55 15 39	11.5	12.0	V	SR:	054 GSC
761272	V603	Cep	21 54 56.8 +66 31 01	11.62	(0.5)	V	SR:	012 GSC
761273	V604	Cep	21 54 59.0 +69 30 34	11.7	12.2	V	SR:	012 GSC
761274	V605	Cep	21 55 14.0 +56 41 19	10.8	11.3	V	SR:	012 GSC
761275	V606	Cep	21 55 24.8 +63 53 22	13.0	13.7	V	SR:	012 GSC
761276	V607	Cep	21 55 27.3 +61 17 14	12.4	12.9	V	SR:	012 GSC
761277	V608	Cep	21 55 34.6 +67 08 07	12.9	13.8	V	SR:	012 GSC
761278	V609	Cep	21 55 34.7 +59 55 08	12.2	13.0	V	SR:	012 GSC
761279	V610	Cep	21 55 44.9 +57 39 21	12.5	13.6	V	SR:	012 GSC
761280	V611	Cep	21 56 11.2 +58 06 46	12.9	13.5	V	SR:	012 GSC
761281	V612	Cep	21 56 31.4 +66 36 05	12.3	13.2	V	SR:	012 GSC
761282	V613	Cep	21 56 59.4 +56 46 08	11.4	12.0	V	SR:	012 GSC
761283	V614	Cep	21 57 07.6 +60 00 40	12.8	13.7	*	SR:	057 USNO
761284	V615	Cep	21 57 26.3 +67 09 23	13.6	14.7	V	SR:	012 GSC
761285	V616	Cep	21 57 35.5 +61 46 07	12.2	12.8	V	SR:	012 GSC
761286	V617	Cep	21 57 36.0 +57 35 41	11.4	11.9	V	SR:	012 GSC
761287	V2269	Cyg	21 58 01.5 +55 03 07	13.4	14.1	V	SR:	054 GSC
761288	V618	Cep	21 58 02.7 +62 00 14	12.8	13.4	V	SR:	012 GSC

Table 1 (continued)

No.	Name	R.A.,Decl., 2000.0 (h m s o ' ")	Max (m)	Min (m)		Type	Ref.
761289	V619 Cep	21 58 17.1 +66 00 28	10.6	11.3	V	SR:	012 GSC
761290	V620 Cep	21 58 25.7 +60 17 22	12.6	13.3	V	SR:	012 GSC
761291	V2270 Cyg	21 58 28.8 +51 05 32	12.1	13.0	*	SR:	057 USNO
761292	V621 Cep	21 58 29.2 +63 50 07	11.5	12.0	V	SR:	012 GSC
761293	V622 Cep	21 58 55.9 +58 19 47	13.0	13.5	V	SR:	012 GSC
761294	V2271 Cyg	21 58 56.7 +55 13 37	12.6	13.4	*	SR	197 USNO
761295	V623 Cep	21 59 06.2 +60 40 54	12.1	12.6	V	SR:	012 GSC
761296	V2272 Cyg	21 59 10.9 +55 07 56	11.1	11.8	V	SR:	054 GSC
761297	V624 Cep	21 59 14.6 +64 22 17	13.3	14.5	V	SR:	012 GSC
761298	V625 Cep	21 59 35.2 +56 48 32	11.5	12.5	V	SR:	012 GSC
761299	V626 Cep	21 59 38.5 +64 27 17	10.8	11.5	V	SR:	012 GSC
761300	V627 Cep	21 59 40.6 +63 59 28	13.2	13.8	V	SR:	012 GSC
761301	V2273 Cyg	22 00 02.5 +50 49 39	10.8	11.5	*	SR:	057 USNO
761302	V628 Cep	22 00 11.5 +60 51 34	11.6	12.2	V	SR:	012 GSC
761303	V629 Cep	22 00 24.4 +55 52 41	10.7	11.7	V	SR:	012 GSC
761304	V630 Cep	22 00 27.0 +67 59 45	13.2	14.2	V	SR:	012 GSC
761305	V631 Cep	22 00 43.4 +65 03 48	13.9	14.5	V	SR:	012 GSC
761306	V632 Cep	22 01 06.6 +58 25 41	12.7	13.3	V	SR:	012 GSC
761307	V374 Peg	22 01 13.1 +28 18 25	3.5	16.0	U	UV	239 274
761308	V375 Peg	22 01 40.7 +10 37 18	12.5	13.5	*	EA:	272 GSC
761309	V633 Cep	22 01 48.2 +61 17 30	13.8	14.5	V	SR:	012 GSC
761310	V634 Cep	22 02 27.6 +66 12 47	11.4	12.5	V	SR:	012 GSC
761311	V635 Cep	22 02 53.1 +56 50 10	10.9	12.2	V	SR:	012 GSC
761312	V376 Peg	22 03 10.8 +18 53 04	7.65	(0.02)	V	EP	241 DM
761313	V636 Cep	22 03 58.4 +59 39 11	11.0	11.8	*	SR:	057 GSC
761314	V637 Cep	22 03 58.8 +55 16 56	13.8	14.5	V	SR:	054 GSC
761315	V638 Cep	22 04 28.8 +68 39 56	10.9	11.6	V	SR:	012 GSC
761316	V639 Cep	22 04 39.2 +53 35 30	12.7	14.0	*	SR:	197 USNO
761317	V377 Peg	22 05 32.5 +17 30 38	7.95	(0.03)	B	DSCTC	242 DM
761318	V640 Cep	22 05 58.0 +60 59 55	11.8	12.9	V	SR:	012 GSC
761319	V641 Cep	22 06 04.9 +55 41 52	12.3	13.1	V	SR:	012 GSC
761320	V642 Cep	22 06 05.3 +58 46 37	13.1	13.7	V	SR:	012 GSC
761321	V643 Cep	22 06 06.1 +59 15 29	11.7	12.4	V	SR:	012 GSC
761322	V644 Cep	22 06 21.1 +59 39 39	10.7	11.7	V	SR:	012 GSC
761323	V645 Cep	22 06 37.9 +59 41 21	11.0	13.0	V	SRA	240 GSC
761324	V646 Cep	22 08 44.0 +61 12 16	11.8	12.8	V	SR:	012 GSC
761325	V647 Cep	22 08 49.4 +55 15 46	14.5	15.2	V	SR:	054 GSC
761326	V648 Cep	22 09 32.2 +55 32 24	12.6	13.8	V	SR:	054 GSC
761327	V649 Cep	22 09 47.6 +61 09 37	12.4	13.2	V	SR:	012 GSC
761328	V650 Cep	22 12 29.8 +55 45 02	12.8	13.7	V	SR:	054 GSC
761329	V651 Cep	22 12 56.2 +59 46 50	11.3	12.3	V	SR:	012 GSC
761330	V434 Lac	22 13 09.3 +54 37 15	12.8	13.5	V	SR:	054 GSC
761331	V652 Cep	22 14 15.5 +59 22 01	11.6	12.3	V	SR:	012 GSC
761332	V435 Lac	22 15 02.2 +54 18 57	15.55	(0.43*)	V	EB	243 243
761333	V436 Lac	22 15 05.3 +54 18 54	14.70	(0.05*)	V	DSCTC	243 243
761334	V653 Cep	22 15 07.3 +58 52 47	13.5	14.2	V	SR:	012 GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0 h m s o ' "	Max m	Min m		Type	Ref.	
761335	V437	Lac	22 15 11.0 +54 19 18	14.89	(0.01*)	V	DSCTC	243	243
761336	V654	Cep	22 15 14.9 +57 46 56	11.5	12.3	V	SR:	012	GSC
761337	V438	Lac	22 15 21.3 +54 18 38	17.34	(0.25*)	V	DSCT:	243	243
761338	V655	Cep	22 15 25.8 +57 32 43	12.9	13.6	V	SR:	012	GSC
761339	V656	Cep	22 17 21.6 +57 58 05	12.1	12.8	V	SR:	012	GSC
761340	V657	Cep	22 18 00.6 +62 36 56	12.5	13.2	V	SR:	012	GSC
761341	V658	Cep	22 18 07.6 +57 01 38	11.6	12.7	V	SR:	054	GSC
761342	V659	Cep	22 18 18.6 +67 39 37	11.8	13.0	V	SR:	012	GSC
761343	V660	Cep	22 19 07.6 +59 44 59	13.7	(14.4	V	SR:	012	GSC
761344	V661	Cep	22 21 08.7 +69 27 57	11.8	12.3	V	SR:	012	GSC
761345	V439	Lac	22 21 29.0 +54 10 26	13.5	14.3	V	SR:	054	GSC
761346	V662	Cep	22 21 29.2 +60 43 12	13.1	13.8	V	SR:	012	GSC
761347	V663	Cep	22 22 57.5 +58 36 54	12.5	13.0	V	SR:	012	GSC
761348	V664	Cep	22 23 51.7 +58 44 17	12.4	13.4	V	SR:	012	GSC
761349	V665	Cep	22 24 59.2 +69 20 33	14.2	14.7	V	SR:	012	GSC
761350	V666	Cep	22 25 12.3 +59 38 37	12.3	12.8	V	SR:	012	GSC
761351	V667	Cep	22 25 48.3 +60 51 44	12.6	13.1	V	SR:	012	GSC
761352	V668	Cep	22 25 50.2 +58 23 32	12.8	13.5	V	SR:	012	GSC
761353	V669	Cep	22 26 38.7 +61 13 32	12.59	(0.5)	V	SR:	012	GSC
761354	V670	Cep	22 27 22.5 +64 29 10	13.5	14.1	V	SR:	012	GSC
761355	V671	Cep	22 27 28.9 +58 42 03	12.3	13.2	V	SR:	012	GSC
761356	V672	Cep	22 27 29.5 +59 26 02	11.2	11.7	V	SR:	012	GSC
761357	V673	Cep	22 28 13.2 +57 47 31	12.2	12.7	V	SR:	054	GSC
761358	V674	Cep	22 28 17.4 +59 14 04	10.6	11.7	V	SR:	012	GSC
761359	V675	Cep	22 28 31.1 +60 27 49	12.0	12.9	V	SR:	054	GSC
761360	V676	Cep	22 28 47.2 +58 32 19	12.4	13.3	V	SR:	012	GSC
761361	V677	Cep	22 28 53.7 +58 01 09	12.3	13.0	V	SR:	054	GSC
761362	V678	Cep	22 29 13.5 +56 55 48	12.9	13.5	V	SR:	054	GSC
761363	V679	Cep	22 29 37.8 +59 30 16	12.2	12.9	V	SR:	012	GSC
761364	V680	Cep	22 29 50.2 +65 19 23	13.4	14.7	V	SR:	012	GSC
761365	V681	Cep	22 30 02.3 +57 03 13	11.7	13.0	V	SR:	054	GSC
761366	V682	Cep	22 31 41.1 +59 00 44	11.3	12.1	V	SR:	012	GSC
761367	V683	Cep	22 31 50.2 +56 59 49	13.0	13.6	V	SR:	054	GSC
761368	V684	Cep	22 31 57.2 +60 13 52	12.9	13.6	V	SR:	054	GSC
761369	V685	Cep	22 32 32.3 +59 34 06	11.64	(0.6)	V	SR:	012	GSC
761370	V686	Cep	22 33 37.3 +63 35 10	11.5	12.0	V	SR:	012	GSC
761371	V687	Cep	22 33 55.2 +63 18 53	11.8	12.3	V	SR:	012	GSC
761372	V688	Cep	22 34 09.5 +58 59 27	12.7	13.3	V	SR:	012	GSC
761373	V689	Cep	22 34 11.9 +63 32 48	13.2	13.8	V	SR:	012	GSC
761374	V690	Cep	22 34 16.5 +67 55 28	10.8	11.3	V	SR:	012	GSC
761375	V691	Cep	22 34 30.8 +68 00 10	12.9	13.7	V	SR:	012	GSC
761376	V692	Cep	22 37 48.7 +63 15 41	12.8	13.7	V	SR:	012	GSC
761377	V693	Cep	22 39 05.4 +65 17 21	12.8	13.6	V	SR:	012	GSC
761378	V694	Cep	22 39 35.4 +66 02 48	13.2	13.7	V	SR:	012	GSC
761379	V695	Cep	22 41 39.0 +67 59 57	14.1	14.8	V	SR:	012	GSC
761380	V696	Cep	22 43 18.1 +67 27 34	10.4	11.2	V	SR:	012	GSC

Table 1 (continued)

No.	Name		R.A.,Decl., 2000.0		Max	Min		Type	Ref.	
			h m s	o ’ "	m	m				
761381	V697	Cep	22 45 28.4	+67 58 39	12.1	12.6	V	SR:	012	GSC
761382	V698	Cep	22 45 52.4	+57 43 07	12.75	13.50	V	EA	244	244
761383	V699	Cep	22 46 00.7	+57 46 50	11.60	11.95	V	EW	244	244
761384	V700	Cep	22 46 08.6	+67 02 56	13.0	13.7	V	SR:	012	GSC
761385	V701	Cep	22 47 30.9	+67 11 49	11.2	11.7	V	SR:	012	GSC
761386	V440	Lac	22 55 25.4	+52 17 09	15.4	16.0	P	RRAB	245	246
761387	V422	And	23 07 57.2	+50 11 44	13.4	14.0	P	EB	245	249
761388	V423	And	23 08 52.5	+52 41 32	15.8	16.7	P	RRAB	245	246
761389	DQ	Gru	23 23 54.5	-53 48 32	6.18	6.25	Hp	DSCTC:	247	DM
761390	V424	And	23 24 39.7	+49 36 01	15.4	16.0	P	RRAB	245	246
761391	V870	Cas	23 27 03.6	+54 37 15	14.1	15.3	P	RRAB	245	248
761392	V425	And	23 27 37.3	+50 17 16	13.3	14.6	P	EA	245	249
761393	V871	Cas	23 34 17.3	+55 53 58	12.5	(0.18)	V	DSCT	250	GSC
761394	V426	And	23 34 28.8	+50 09 54	14.1	14.9	P	SRB	245	249
761395	V427	And	23 34 43.9	+50 31 11	14.4	16.2	P	SRA	245	249
761396	V378	Peg	23 40 04.3	+30 17 48	14.4	(0.34)	B	NL	251	095
761397	V872	Cas	23 41 32.5	+51 20 01	13.8	14.4	P	EB	245	249
761398	BX	Scl	23 43 54.5	-28 18 34	13.42	13.71	V	SXPHE	252	252
761399	V702	Cep	23 50 05.2	+68 02 04	13.74	13.78	V	GDOR	253	253
761400	BY	Scl	23 51 32.1	-25 45 46	13.83	(0.05)	V	SXPHE:	252	252
761401	V873	Cas	23 53 44.9	+50 59 19	13.5	15.3	V	SRA	002	002
761402	V379	Peg	23 53 51.0	+23 09 20	13.9	(16.2	*	ZAND:	254	005
761403	V874	Cas	23 56 32.2	+56 44 18	13.98	14.31	V	EA	255	255
761404	V875	Cas	23 56 38.7	+56 43 59	16.96	17.82	V	EW:	255	255
761405	V876	Cas	23 56 50.1	+56 49 30	17.26	17.72 :	V	EW:	255	255
761406	V877	Cas	23 57 39.5	+56 41 00	15.32	15.58	V	EW	255	255

Table 2

V414	And =	760004	= LD 321 = IRAS 00070+3730 = GSC 2781.01738.
V415	And =	760018	= LD 335 = IRAS 00479+4614.
V416	And =	760021	= LD 338 = IRAS 01076+4450 = GSC 3264.00924.
V417	And =	760022	= LD 339 = IRAS 01131+4955 = GSC 3272.00151.
V418	And =	760024	= LD 341 = IRAS 01270+4954 = GSC 3286.02177.
V419	And =	760031	= ADS 01672 = HD 13079 (F0) = BD+38°418 = HIP 010023 = SAO 055300 = PPM 067008 = GSC 2833.01015.
V420	And =	760033	= TAV J0218+507 = Q 1998/073 = IRAS 02150+5032.
V421	And =	760046	= TASV 0220+48 = Q 1994/060 = IRAS 02200+4830 = CCS 97 = CCS-II 344 = GSC 3298.00175.
V422	And =	761387	= NSV 14435 = CSV 5662 = SVS 738 = Prager 5725 = GSC 3631.01314.
V423	And =	761388	= NSV 14438 = CSV 5666 = S 4630.
V424	And =	761390	= NSV 14547 = CSV 5719 = S 4636.
V425	And =	761392	= NSV 14578 = CSV 5731 = SVS 742 = Prager 5756 = GSC 3645.1873.
V426	And =	761394	= NSV 14625 = CSV 5759 = SVS 744 = Prager 5766 = GSC 3645.00777.
V427	And =	761395	= NSV 14628 = CSV 5761 = SVS 745 = Prager 5767 = GSC 3645.01083.
BD	Ant =	760744	= Had V35 = IRAS 10158–3547.
MO	Aqr =	761176	= BD–02°5436 = PPM 204765 = GSC 5196.00130.
V1495	Aql =	761034	= Antipin Var 67 = GSC 5115.00919.
V1496	Aql =	761035	= Antipin Var 68 = GSC 5115.01270.
V1497	Aql =	761037	= Mis V0137 = IRAS 18548–0338.
V1498	Aql =	761039	= Mis V0677 = IRAS 18552+1004.
V1499	Aql =	761041	= Mis V0250 = IRAS 18552–0203.
V1500	Aql =	761043	= Mis V0156 = IRAS 18554–0549.
V1501	Aql =	761046	= Mis V0709.
V1502	Aql =	761048	= Mis V0135 = IRAS 18561–0945.
V1503	Aql =	761049	= Mis V0340 = IRAS 18563–0327.
V1504	Aql =	761050	= Mis V0679 = IRAS 18567+1038.
V1505	Aql =	761053	= Mis V0161 = IRAS 18565–0143.
V1506	Aql =	761056	= Mis V0676 = IRAS 18574+1004.
V1507	Aql =	761057	= Mis V0249 = IRAS 18572–0318.
V1508	Aql =	761058	= Mis V0239.
V1509	Aql =	761060	= Mis V0369 = IRAS 18575–0301.
V1510	Aql =	761061	= Mis V0157 = IRAS 18576–0611.
V1511	Aql =	761063	= Mis V0701.
V1512	Aql =	761064	= Mis V0142.
V1513	Aql =	761065	= Mis V0370 = IRAS 18584–0315.
V1514	Aql =	761066	= Mis V0051.
V1515	Aql =	761067	= Mis V0534.
V1516	Aql =	761068	= Mis V0811.
V1517	Aql =	761070	= Mis V0155 = IRAS 18589–0650.
V1518	Aql =	761071	= Mis V0643.
V1519	Aql =	761072	= Mis V0519 = IRAS 18595+1201.
V1520	Aql =	761073	= Hass No.08 = IRAS 18593–0205 = GSC 5132.00390.
V1521	Aql =	761074	= Mis V0686.
V1522	Aql =	761076	= Mis V0235.
V1523	Aql =	761077	= Mis V0698 = IRAS 18598–0116.
V1524	Aql =	761078	= Mis V0238 = GSC 5140.00687.
V1525	Aql =	761079	= Mis V0162 = IRAS 19001–0147.
V1526	Aql =	761080	= Hass No.04 = IRAS 19035–0134.
V1527	Aql =	761081	= Hass No.15 = IRC 00413 = RAFGL 5343S = IRAS 19061–0407.
V1528	Aql =	761082	= Hass No.05 = IRAS 19062–0206.
V1529	Aql =	761087	= No.7 in the V1333 Aql region.
V1530	Aql =	761088	= No.1 in the V1333 Aql region.
V1531	Aql =	761089	= No.6 in the V1333 Aql region.
V1532	Aql =	761091	= No.4 in the V1333 Aql region.
V1533	Aql =	761092	= No.9 in the V1333 Aql region.
V1534	Aql =	761093	= No.2 in the V1333 Aql region.
V1535	Aql =	761094	= No.3 in the V1333 Aql region.
V1536	Aql =	761095	= No.8 in the V1333 Aql region.
V1537	Aql =	761096	= No.5 in the V1333 Aql region.
V1538	Aql =	761105	= Be V17 = GSC 0477.03880.

Table 2 (continued)

V1539	Aql =	761106	= HD 182844 (B8) = BD+03°4021 = SAO 124629 = PPM 167860 = GSC 0469.02661.
V1540	Aql =	761107	= Mis V0523 = IRAS 19257+1023.
V1541	Aql =	761118	= IRAS 19403–0520.
V1542	Aql =	761124	= Be V8 = GSC 1057.01309.
V1543	Aql =	761127	= Be V22 = GSC 1062.01819.
V1544	Aql =	761130	= Be V21 = GSC 1062.02668.
V1545	Aql =	761133	= IRAS 19543–0753 = GSC 5738.00334.
V1546	Aql =	761141	= Mis V0356 = GSC 1075.00782.
V1547	Aql =	761155	= Be V23 = GSC 1076.01805.
V877	Ara =	760878	= NSV 08383 = CSV 7612 = vH 3 [152].
AU	Ari =	760030	= CSV 102372 = NSV 00731 = BD+16°244 = HIP 010013 = SAO 092808 = PPM 117982 = IRAS 02062+1720 = GSC 1217.01527.
AV	Ari =	760032	= NSV 00738 = BS 0631 = 15 Ari = HD 13325 (Ma) = BD+18°277 = HIP 010155 = SAO 092822 = PPM 118003 = IRAS 02078+1915 = IRC+20041 = AFGL 303 = GSC 1217.01560.
V497	Aur =	760121	= Tmz V130 = CCS 255 = CCS-II 795 = GSC 3344.02390.
V498	Aur =	760122	= Tmz V155 = IRAS 04522+2910 = GSC 1844.01104.
V499	Aur =	760123	= Tmz V136 = IRAS 04525+3643W = GSC 2399.01075.
V500	Aur =	760124	= Tmz V152 = IRAS 04531+3259 = GSC 2391.00308.
V501	Aur =	760126	= W72 = HD 282600 (K0) = RX J0457.1+3142 = GSC 2388.00857.
V502	Aur =	760132	= Tmz V146 = IRAS 05009+3754 = GSC 2895.00669.
V503	Aur =	760135	= Tmz V153 = IRAS 05076+3314 = GSC 2395.01006.
V504	Aur =	760143	= Tmz V129 = IRAS 05223+4509 = GSC 3358.02389.
V505	Aur =	760144	= Tmz V022 = IRAS 05237+4839 = IRC+50145 = AFGL 746 = GSC 3363.00399.
V506	Aur =	760146	= Tmz V126 = IRAS 05271+4248 = GSC 2918.00731.
V507	Aur =	760366	= Tmz V244 = IRAS 05477+5420.
V508	Aur =	760369	= Tmz V257 = IRAS 05540+3222.
V509	Aur =	760378	= Tmz V245 = IRAS 06016+5224.
V510	Aur =	760382	= Tmz V255 = IRAS 06032+3758 = GSC 2925.01675.
V511	Aur =	760385	= Tmz V246 = IRAS 06052+5017 = GSC 3382.00157.
V512	Aur =	760388	= Tmz V251 = IRAS 06088+4329 = CCS-II 1182 = GSC 2938.01508.
V513	Aur =	760390	= Tmz V247 = IRAS 06103+5042 = GSC 3387.00126.
V514	Aur =	760396	= Tmz V259 = IRAS 06139+3039 = GSC 2420.00765.
V515	Aur =	760400	= Tmz V248 = IRAS 06153+5029 = CCS-II 1217 = GSC 3383.00025.
V516	Aur =	760404	= Tmz V250 = IRAS 06177+4159.
V517	Aur =	760406	= Tmz V249 = IRAS 06210+5148 = GSC 3388.02226.
V518	Aur =	760410	= Tmz V258 = IRAS 06234+2921 = IRC+30151 = GSC 1891.01040.
V519	Aur =	760417	= NSV 16894 = Tmz V252 = IRAS 06291+4319 = AFGL 954 = CCS-II 1291 = GSC 2940.01646.
V520	Aur =	760418	= Tmz V256 = IRAS 06300+3456 = GSC 2430.00757.
V521	Aur =	760420	= Tmz V253 = IRAS 06305+4600 = GSC 3377.01218.
V522	Aur =	760425	= Tmz V254 = IRAS 06347+3501.
V523	Aur =	760483	= Mis V0002 = GSC 2965.00210.
FT	Boo =	760803	= Tmz V042 = GSC 3465.00188.
FU	Boo =	760804	= Tmz V734 = GSC 1472.01141.
FV	Boo =	760815	= NSV 20253 = Tmz V043 = IRAS 15060+0947 [264] = GSC 0919.00029.
FW	Boo =	760820	= Tmz V330 = GSC 3488.00098.
FX	Boo =	760825	= Tmz V071.
HX	Cam =	760057	= Tmz V183 = IRAS 03268+6037 = CCS 145 = CCS-II 504 = GSC 4062.00594.
HY	Cam =	760058	= Tmz V195 = IRAS 03291+5348 = GSC 3703.00439.
HZ	Cam =	760059	= Tmz V193 = IRAS 03329+5318 = GSC 3716.00200.
II	Cam =	760061	= Tmz V169 = IRAS 03353+6844 = GSC 4327.01162.
IK	Cam =	760063	= Tmz V162 = IRAS 03362+6729 = GSC 4327.02748.
IL	Cam =	760066	= Tmz V163 = IRAS 03390+6731.
IM	Cam =	760080	= Tmz V201 = GSC 3718.00776.
IN	Cam =	760089	= Tmz V194 = IRAS 04083+5354 = GSC 3718.00688.
IO	Cam =	760102	= Tmz V182 = IRAS 04182+5628 = GSC 3727.01573.

Table 2 (continued)

IP	Cam =	760107	= Tmz V200 = IRAS 04219+5249 = CCS 207 = CCS-II 680 = GSC 3719.01372.
IQ	Cam =	760108	= KPD 0422+5421.
IR	Cam =	760110	= Tmz V173 = IRAS 04254+5831 = CCS-II 691 = GSC 3744.00612.
IS	Cam =	760113	= Tmz V157 = GSC 4069.00582.
IT	Cam =	760114	= Tmz V065 = IRAS 04300+5727 = GSC 3740.00711.
IU	Cam =	760117	= Tmz V159 = IRAS 04343+6541 = GSC 4090.00058.
IV	Cam =	760131	= Tmz V223 = IRAS 04592+6743 = GSC 4342.00354.
IW	Cam =	760133	= Tmz V224 = IRAS 05036+6612.
IX	Cam =	760134	= Tmz V123 = IRAS 05061+6210 = GSC 4084.01302.
IY	Cam =	760136	= Tmz V225 = IRAS 05098+6402 = GSC 4088.00476.
IZ	Cam =	760138	= Tmz V228 = IRAS 05129+6448 = GSC 4088.00478.
KK	Cam =	760139	= Tmz V227 = IRAS 05148+6422 = GSC 4088.00601.
KL	Cam =	760141	= Tmz V226 = IRAS 05178+6416 = GSC 4088.00605.
KM	Cam =	760154	= Tmz V122 = IRAS 05296+5751 = GSC 3757.01910.
KN	Cam =	760360	= Tmz V010 = IRAS 05322+6723 = GSC 4093.00514.
KO	Cam =	760364	= Tmz V240 = IRAS 05434+5631 = GSC 3758.02373.
KP	Cam =	760365	= Tmz V229 = IRAS 05435+6908 = GSC 4344.00904.
KQ	Cam =	760368	= Tmz V232 = IRAS 05512+6626 = GSC 4106.00538.
KR	Cam =	760374	= Tmz V239 = IRAS 05595+5932 = CSS-II 177 = GSC 3763.02451.
KS	Cam =	760383	= Tmz V242 = IRAS 06040+5758 = GSC 3759.01365.
KT	Cam =	760386	= Tmz V235 = IRAS 06055+6744 = GSC 4345.00982.
KU	Cam =	760391	= Tmz V234 = IRAS 06089+6839 = GSC 4345.00719.
KV	Cam =	760447	= Tmz V233 = IRAS 06365+6453 = GSC 4105.00750.
KW	Cam =	760450	= Tmz V231 = IRAS 06437+6424 = GSC 4105.00297.
GR	Cnc =	760570	= Tmz V381 = IRAS 07541+0950 = CCS-II 1953 = GSC 0784.00657.
GS	Cnc =	760629	= BD+28°1572 = Tmz V513 = IRAS 08120+2840 = GSC 1940.00897.
GT	Cnc =	760647	= Tmz V378 = IRAS 08192+1346 = GSC 0807.01001.
GU	Cnc =	760663	= Tmz V377 = IRAS 08234+1531 = GSC 1379.01312.
GV	Cnc =	760667	= Tmz V075 = GSC 1387.00727.
GW	Cnc =	760690	= Tmz V003 = GSC 1399.01081.
GX	Cnc =	760692	= EXO 0848+1228 = GSC 0813.01760.
GY	Cnc =	760722	= RX J0909.8+1849 = GSC 1404.01830.
GZ	Cnc =	760730	= Tmz V034 = RX J0915.8–0900 = 1RXS J091552.3–090056 = GSC 0819.00892.
HH	Cnc =	760731	= Tmz V036.
DF	CVn =	760793	= NSV 05904 = CSV 6953 = Wr 125 [120] = GSC 3021.02642.
DG	CVn =	760799	= G 165-008 = LP 323-158 = IRXS J133146+291631 = GSC 2003.00139.
OV	CMa =	760393	= Tmz V282 = IRAS 06135–1207 = GSC 5371.02056.
OW	CMa =	760397	= Tmz V281 = IRAS 06165–1411 = GSC 5375.02338.
OX	CMa =	760414	= Tmz V096 = IRAS 06269–2743 = GSC 6515.01569.
OY	CMa =	760415	= Tmz V275 = IRAS 06266–1148 = CSS-II 221 = GSC 5372.02416.
OZ	CMa =	760416	= Tmz V098 = IRAS 06277–1545 = GSC 5947.03196.
PP	CMa =	760419	= Tmz V097 = IRAS 06315–1940.
PQ	CMa =	760421	= Tmz V273 = IRAS 06321–1339 = GSC 5377.02922.
PR	CMa =	760422	= Tmz V094 = IRAS 06325–2635 = GSC 6516.02192.
PS	CMa =	760423	= Tmz V093 = IRAS 06337–2619 = GSC 6516.02392.
PT	CMa =	760424	= Tmz V274 = IRAS 06343–1302 = GSC 5373.02355.
PU	CMa =	760430	= RX J0640–24.
PV	CMa =	760448	= Tmz V103 = IRAS 06429–2519 = GSC 6525.01105.
PW	CMa =	760449	= Tmz V102 = IRAS 06451–2518 = GSC 6525.01595.
PX	CMa =	760453	= V2 (Tombaugh 2).
PY	CMa =	760454	= V5 (Tombaugh 2).
PZ	CMa =	760455	= V6 (Tombaugh 2).
QQ	CMa =	760456	= V4 (Tombaugh 2).
QR	CMa =	760457	= V3 (Tombaugh 2).
QS	CMa =	760458	= V1 (Tombaugh 2).
QT	CMa =	760459	= Tmz V109 = IRAS 07076–1426 = GSC 5406.01823.
QU	CMa =	760462	= CoD–25°4238 = D 266 (NGC 2354) = GSC 6528.01240.
QV	CMa =	760464	= Had V39 = IRAS 07132–1743.
QW	CMa =	760465	= Tmz V342 = IRAS 07157–2809 = CCS 711 = CCS-II 1644.

Table 2 (continued)

QX CMa = 760466 = CPD–24°2197 = Johnson 3 (NGC 2362).
QY CMa = 760467 = CPD–24°2208 = Johnson 16 (NGC 2362).
QZ CMa = 760469 = Tmz V365 = IRAS 07172–2946 = GSC 6549.03378.
V335 CMa = 760470 = Tmz V364 = IRAS 07176–3112 = GSC 7103.02030.
V336 CMa = 760471 = Tmz V345 = IRAS 07180–2556.
V337 CMa = 760472 = Tmz V327 = IRAS 07191–2016.
V338 CMa = 760473 = Tmz V317 = GSC 5966.00612.
V339 CMa = 760474 = Tmz V328 = IRAS 07194–2021 = GSC 5974.03942.
V340 CMa = 760475 = Tmz V373 = IRAS 07196–2851 = CCS 734 = CCS-II 1677 = Wray 18-13 = GSC 6549.01216.
V341 CMa = 760476 = Tmz V356 = IRAS 07197–2824 = GSC 6549.01201.
V342 CMa = 760477 = Tmz V316 = IRAS 07194–1529 = CCS 729 = CCS-II 1672.
V343 CMa = 760478 = Tmz V357 = IRAS 07198–2832 = GSC 6549.01565.
V344 CMa = 760481 = Tmz V340 = IRAS 07207–2432 = GSC 6541.00693.
V345 CMa = 760482 = Tmz V318 = IRAS 07215–1527 = CCS 746 = CCS-II 1694.
V346 CMa = 760489 = Tmz V375 = IRAS 07235–2945 = GSC 6550.04308.
V347 CMa = 760490 = Tmz V326 = IRAS 07233–1555.
V348 CMa = 760491 = Tmz V344 = IRAS 07235–2156 = GSC 5978.00671.
V349 CMa = 760492 = Tmz V304 = IRAS 07236–1138.
BZ CMi = 760460 = Be V9 = GSC 0171.02059.
CC CMi = 760486 = Tmz V287 = IRAS 07220+1214 = GSC 0772.01474.
CD CMi = 760487 = Be V34 = GSC 0768.00707.
CE CMi = 760488 = Tmz V291 = HS 215 [259] = IRAS 07229+0041.
CF CMi = 760493 = Be V42 = GSC 0768.00618.
CG CMi = 760494 = Tmz V292 = IRAS 07241+0232 = CCS 758 = CCS-II 1710.
CH CMi = 760495 = Tmz V288 = IRAS 07249+0925 = GSC 0764.00175.
CI CMi = 760509 = Tmz V286 = IRAS 07304+1108 = GSC 0769.00404.
CK CMi = 760512 = Tmz V285 = IRAS 07330+1107 = GSC 0769.00961.
CL CMi = 760527 = Tmz V290 = IRAS 07371+0319 = GSC 0183.02025.
CM CMi = 760529 = Tmz V289 = IRAS 07373+0606 = GSC 0191.00520.
CN CMi = 760543 = Tmz V293 = IRAS 07432+0103.
CO CMi = 760553 = Tmz V380 = IRAS 07494+1036 = GSC 0783.00856.
CP CMi = 760571 = Tmz V387 = IRAS 07543+0330 = GSC 0185.00987.
CQ CMi = 760579 = Tmz V388 = IRAS 07572+0158 = GSC 0181.01397.
CR CMi = 760597 = Tmz V385 = IRAS 08034+0318 = GSC 0198.01327.
CS CMi = 760598 = Tmz V384 = IRAS 08037+0331 = GSC 0198.00110.
CT CMi = 760610 = Tmz V391 = IRAS 08056+0052 = GSC 0195.02263.
CU CMi = 760616 = Tmz V389 = IRAS 08067+0517 = GSC 0203.01031.
CV CMi = 760619 = Tmz V383 = IRAS 08085+0049 = GSC 0195.01502.
V542 Car = 760749 = R15 (IC 2602) = RX J1033.6–6413 = GSC 8964.00073.
V543 Car = 760750 = R24A (IC 2602) = RX J1035.8–6418.
V544 Car = 760751 = R26 (IC 2602) = RX J1036.3–6414.
V545 Car = 760752 = R27 (IC 2602) = RX J1036.4–6500.
V546 Car = 760753 = R29 (IC 2602) = RX J1036.6–6447 = GSC 8965.01524.
V547 Car = 760754 = R31 (IC 2602) = RX J1037.3–6443.
V548 Car = 760755 = R32 (IC 2602) = RX J1037.8–6400.
V549 Car = 760756 = R44 (IC 2602) = RX J1039.9–6336.
V550 Car = 760757 = R43 (IC 2602) = RX J1039.9–6359 = GSC 8965.00238.
V551 Car = 760758 = R50 (IC 2602) = RX J1040.5–6442.
V552 Car = 760759 = R52 (IC 2602) = RX J1040.8–6442 = GSC 8965.00386.
V553 Car = 760760 = R53B (IC 2602) = RX J1041.0–6419.
V554 Car = 760761 = R56 (IC 2602) = RX J1041.7–6427.
V555 Car = 760762 = CPD–64°1428 = W79 (IC 2602) = GSC 8965.00599.
V556 Car = 760763 = R57 (IC 2602) = RX J1042.4–6436.
V557 Car = 760764 = CPD–63°1595 = HD 307938 (G0) = B102 (IC 2602) = R58 (IC 2602) = RX J1042.6–6421 = GSC 8965.00261.
V558 Car = 760765 = CPD–63°1624 = R66 (IC 2602) = RX J1044.1–6359 = GSC 8965.00432.
V559 Car = 760766 = CPD–63°1626 = HD 307936 (F7) = W85 (IC 2602) = R70 (IC 2602) = RX J1044.3–6415 = GSC 8965.00318.

Table 2 (continued)

V560	Car =	760767	= NSV 18503 = CoD–59°3294 = CPD–59°2587 = HD 93205 (B) = SAO 238418 = PPM 339398 = IDS 1040.7S5913A = LSS 1849 = GSC 8626.02810.
V561	Car =	760768	= CPD–64°1464 = HD 307979 (G0) = B120 (IC 2602) = R72 (IC 2602) = RX J1044.9–6502 = GSC 8965.00163.
V562	Car =	760769	= R77 (IC 2602) = RX J1045.3–6332.
V563	Car =	760770	= CPD–63°1638 = HD 308016 (G5) = B134 (IC 2602) = R80 (IC 2602) = RX J1045.4–6425 = GSC 8965.00127.
V564	Car =	760771	= CPD–63°1643 = R83 (IC 2602) = RX J1046.2–6402 = GSC 8965.00308.
V565	Car =	760772	= R88A (IC 2602) = RX J1046.5–6403.
V566	Car =	760773	= R89 (IC 2602) = RX J1046.8–6334.
V567	Car =	760774	= CPD–63°1678 = HD 308013 (G) = B132 (IC 2602) = R92 (IC 2602) = RX J1048.3-6409 = GSC 8965.01371.
V568	Car =	760775	= R93 (IC 2602) = RX J1048.4–6422.
V569	Car =	760776	= R94 (IC 2602) = RX J1049.4–6439.
V570	Car =	760777	= CPD–64°1499 = R95A (IC 2602) = RX J1049.8–6446 = GSC 8965.01276.
V571	Car =	760778	= R96 (IC 2602) = RX J1049.8–6348 = GSC 8965.00644.
V855	Cas =	760002	= LD 319.
V856	Cas =	760003	= LD 320 = IRAS 00041+5210.
V857	Cas =	760005	= LD 322 = IRAS 00070+5253.
V858	Cas =	760007	= LD 326 = IRAS 00164+5145.
V859	Cas =	760008	= LD 327 = IRAS 00186+5104.
V860	Cas =	760010	= LD 328 = GSC 3256.00458.
V861	Cas =	760011	= NSV 15131 = IRAS 00336+6744 = GSC 4295.00874.
V862	Cas =	760012	= LD 331 = IRAS 00358+5259.
V863	Cas =	760013	= NSV 15159 = HD 4004 (Ob) = BD+63°83 = HIP 003415 = LS I+64°34 = WR 001 = GSC 4024.01467.
V864	Cas =	760014	= LD 333 = Q 1996/082 = IRAS 00422+4824 = GSC 3266.01137.
V865	Cas =	760016	= NSV 15174 = IRAS 00459+6749.
V866	Cas =	760017	= Tmz V063 = GSC 3274.01984.
V867	Cas =	760020	= NSV 15205 = IRAS 00534+6031.
V868	Cas =	760028	= V1 (NGC 663).
V869	Cas =	760029	= V2 (NGC 663).
V870	Cas =	761391	= NSV 14570 = CSV 5727 = AN 209.1943 = S 3536.
V871	Cas =	761393	= GSC 4004.01211.
V872	Cas =	761397	= NSV 14668 = CSV 5776 = SVS 748 = Prager 5779 = GSC 3650.01224.
V873	Cas =	761401	= LD 318 = IRAS 23512+5042 = GSC 3651.00927.
V874	Cas =	761403	= V1 (NGC 7789).
V875	Cas =	761404	= V2 (NGC 7789).
V876	Cas =	761405	= V3 (NGC 7789).
V877	Cas =	761406	= NSV 26179 = V6 (NGC 7789) [255] = 3 (NGC 7789) [256].
V1033	Cen =	760784	= Cen 3 [005] = RX J1141.3–6410.
V1034	Cen =	760806	= CoD–59°5310 = CPD–59°5635 = HD 127695 (F0) = SAO 252804 = PPM 360856 = GSC 9007.02961.
V1035	Cen =	760807	= CoD–61°4452 = CPD–61°4618 = HD 127711 (F0) = SAO 252807 = PPM 360860 = GSC 9011.05247.
V1036	Cen =	760808	= CoD–62°859 = CPD–62°4199 = HD 127927 (A5) = SAO 252819 = PPM 360882 = GSC 9011.04295.
V1037	Cen =	760812	= Tmz V749 = IRAS 14538–2953 = GSC 7298.00195.
V1038	Cen =	760813	= Had V12 = IRAS 14595–4124 = GSC 7829.02806.
V535	Cep =	761182	= Tmz V576 = IRAS 21165+6507 = GSC 4256.00268.
V536	Cep =	761183	= Tmz V577 = IRAS 21181+6518 = GSC 4256.01105.
V537	Cep =	761184	= Tmz V575 = IRAS 21193+6429 = GSC 4256.02789.
V538	Cep =	761185	= Tmz V578 = IRAS 21203+6329 = GSC 4252.01147.
V539	Cep =	761186	= Tmz V608 = IRAS 21213+6116 = GSC 4248.01005.
V540	Cep =	761187	= Tmz V609 = IRAS 21220+6004 = GSC 4248.00754.
V541	Cep =	761188	= Tmz V607 = IRAS 21223+6145 = GSC 4252.01098.
V542	Cep =	761190	= Tmz V610 = IRAS 21232+5930 = GSC 3978.00388.
V543	Cep =	761191	= Tmz V616 = IRAS 21255+5646 = GSC 3974.01003.
V544	Cep =	761192	= Tmz V615 = IRAS 21257+5800 = GSC 3978.01386.
V545	Cep =	761193	= Tmz V571 = IRAS 21270+6607 = GSC 4261.00740.

Table 2 (continued)

V546 Cep = 761194 = Tmz V605 = IRAS 21272+6137 = GSC 4249.00755.
V547 Cep = 761195 = Tmz V611 = IRAS 21273+5840 = GSC 3978.01445.
V548 Cep = 761196 = Tmz V572 = IRAS 21279+6526 = GSC 4261.00009.
V549 Cep = 761197 = Tmz V606 = IRAS 21287+6128 = GSC 4249.00037.
V550 Cep = 761198 = Tmz V614 = IRAS 21288+5804 = CCS-II 5336 = GSC 3978.01247.
V551 Cep = 761199 = Tmz V612 = IRAS 21292+5833 = GSC 3978.00530.
V552 Cep = 761200 = Tmz V613 = IRAS 21295+5825 = GSC 3978.01279.
V553 Cep = 761201 = Tmz V545 = IRAS 21301+6740 = GSC 4461.02491.
V554 Cep = 761202 = Tmz V573 = IRAS 21309+6507 = GSC 4257.00306.
V555 Cep = 761203 = Tmz V574 = IRAS 21309+6456 = GSC 4257.01780.
V556 Cep = 761204 = Tmz V713 = IRAS 21313+6029 = GSC 4249.02489.
V557 Cep = 761207 = Tmz V617 = GSC 3975.01741.
V558 Cep = 761208 = Tmz V711 = IRAS 21327+6100 = GSC 4249.00991.
V559 Cep = 761209 = Tmz V579 = IRAS 21338+6238 = GSC 4253.00722.
V560 Cep = 761211 = Tmz V619 = IRAS 21345+5527 = GSC 3971.01067.
V561 Cep = 761215 = Tmz V618 = IRAS 21354+5644 = GSC 3975.01144.
V562 Cep = 761217 = Tmz V712 = IRAS 21358+6051 = GSC 4249.02144.
V563 Cep = 761218 = Tmz V580 = IRAS 21361+6257 = CCS-II 5392 = GSC 4253.00488.
V564 Cep = 761219 = Tmz V544 = IRAS 21377+6905 = GSC 4462.00704.
V565 Cep = 761220 = Tmz V632 = IRAS 21376+6132 = GSC 4249.01001.
V566 Cep = 761221 = Tmz V546 = IRAS 21382+6802 = GSC 4462.02655.
V567 Cep = 761222 = Tmz V547 = IRAS 21384+6744 = GSC 4462.01047.
V568 Cep = 761224 = Tmz V623 = IRAS 21382+5725 = GSC 3975.00640.
V569 Cep = 761226 = Tmz V620 = IRAS 21384+5537 = GSC 3971.00679.
V570 Cep = 761227 = Tmz V714 = IRAS 21389+6037 = GSC 4249.02432.
V571 Cep = 761228 = Tmz V621 = IRAS 21392+5534 = GSC 3971.00637.
V572 Cep = 761229 = Tmz V631 = IRAS 21395+6151 = GSC 4253.01889.
V573 Cep = 761230 = Tmz V570 = IRAS 21401+6627 = GSC 4261.00293.
V574 Cep = 761231 = Tmz V548 = IRAS 21405+6739 = GSC 4462.02051.
V575 Cep = 761232 = Tmz V628 = IRAS 21402+5823 = GSC 3979.00732.
V576 Cep = 761233 = Tmz V622 = IRAS 21404+5640 = GSC 3975.01240.
V577 Cep = 761235 = Tmz V633 = IRC+60324 = IRAS 21413+6131 = GSC 4249.00719.
V578 Cep = 761237 = Tmz V550 = IRAS 21427+6739 = GSC 4462.01665.
V579 Cep = 761242 = Tmz V549 = IRAS 21436+6735 = GSC 4462.00181.
V580 Cep = 761243 = Tmz V581 = IRAS 21434+6307 = GSC 4266.00395.
V581 Cep = 761244 = Tmz V626 = IRAS 21436+5734 = GSC 3975.00775.
V582 Cep = 761245 = Tmz V569 = IRAS 21443+6546 = GSC 4274.01661.
V583 Cep = 761246 = Tmz V551 = IRAS 21448+6801 = GSC 4462.02539.
V584 Cep = 761247 = Tmz V583 = IRAS 21445+6335 = GSC 4270.00762.
V585 Cep = 761248 = Tmz V582 = IRAS 21445+6321 = GSC 4266.01482.
V586 Cep = 761249 = Tmz V634 = IRAS 21444+6146 = GSC 4266.00612.
V587 Cep = 761250 = Tmz V650 = IRAS 21443+5902 = GSC 3979.01327.
V588 Cep = 761251 = Tmz V652 = IRAS 21449+5847 = CCS-II 5449 = GSC 3979.01508.
V589 Cep = 761252 = Tmz V638 = IRAS 21454+6112 = GSC 4262.01324.
V590 Cep = 761253 = Tmz V649 = IRAS 21454+5920 = GSC 3980.01185.
V591 Cep = 761256 = Tmz V543 = IRAS 21473+6838 = GSC 4462.01800.
V592 Cep = 761258 = Tmz V585 = IRAS 21483+6435 = GSC 4270.01848.
V593 Cep = 761259 = Tmz V654 = IRAS 21481+5548 = GSC 3972.02692.
V594 Cep = 761261 = Tmz V653 = IRAS 21484+5540 = GSC 3972.01490.
V595 Cep = 761262 = Tmz V542 = IRAS 21495+6903 = GSC 4462.00198.
V596 Cep = 761263 = Tmz V568 = IRAS 21500+6603 = GSC 4274.00480.
V597 Cep = 761264 = Tmz V639 = IRAS 21502+6048 = GSC 4262.02061.
V598 Cep = 761265 = Tmz V564 = IRAS 21512+6708 = GSC 4274.00503.
V599 Cep = 761267 = Tmz V584 = IRAS 21517+6447 = GSC 4270.01989.
V600 Cep = 761268 = Tmz V715 = IRAS 21521+5903 = GSC 3980.01227.
V601 Cep = 761269 = Tmz V698 = IRAS 21528+5636 = GSC 3976.00768.
V602 Cep = 761270 = Tmz V565 = IRAS 21533+6631 = GSC 4274.00658.
V603 Cep = 761272 = Tmz V566 = IRAS 21537+6616 = GSC 4274.01586.
V604 Cep = 761273 = Tmz V541 = IRAS 21539+6916 = CCS-II 5507 = GSC 4466.02306.
V605 Cep = 761274 = Tmz V697 = IRAS 21535+5627 = GSC 3976.00823.
V606 Cep = 761275 = Tmz V587 = IRAS 21540+6339 = GSC 4270.00794.

Table 2 (continued)

V607 Cep = 761276 = Tmz V640 = IRAS 21539+6103 = GSC 4262.01578.
V608 Cep = 761277 = Tmz V562 = IRAS 21543+6653 = GSC 4274.00787.
V609 Cep = 761278 = Tmz V648 = IRAS 21540+5940 = CCS 3085 = CCS-II 5502 = GSC 3980.00483.
V610 Cep = 761279 = Tmz V655 = CCS 3086 = CCS-II 5503 = IRAS 21541+5725 = GSC 3976.00262.
V611 Cep = 761280 = Tmz V656 = IRAS 21545+5752 = GSC 3976.00021.
V612 Cep = 761281 = Tmz V567 = GSC 4274.00458.
V613 Cep = 761282 = Tmz V696 = IRAS 21553+5631 = GSC 3976.01051.
V614 Cep = 761283 = Mis V0526 = IRAS 21555+5946.
V615 Cep = 761284 = Tmz V563 = IRAS 21562+6655 = GSC 4274.00813.
V616 Cep = 761285 = Tmz V641 = IRAS 21560+6131 = CCS 3094 = CCS-II 5523 = GSC 4262.00479.
V617 Cep = 761286 = Tmz V693 = IRAS 21559+5721 = GSC 3976.00447.
V618 Cep = 761288 = Tmz V642 = IRAS 21565+6145 = GSC 4266.01487.
V619 Cep = 761289 = Tmz V593 = IRAS 21569+6546 = GSC 4274.01313.
V620 Cep = 761290 = Tmz V647 = IRAS 21568+6002 = GSC 4262.01222.
V621 Cep = 761292 = Tmz V588 = IRAS 21570+6335 = CCS-II 5536 = GSC 4270.00008.
V622 Cep = 761293 = Tmz V657 = IRAS 21572+5805 = GSC 3980.01224.
V623 Cep = 761295 = Tmz V646 = IRAS 21575+6026 = GSC 4262.01660.
V624 Cep = 761297 = Tmz V590 = IRAS 21578+6407 = GSC 4270.03270.
V625 Cep = 761298 = Tmz V695 = IRAS 21578+5634 = GSC 3976.00832.
V626 Cep = 761299 = Tmz V591 = IRAS 21582+6412 = GSC 4270.02403.
V627 Cep = 761300 = Tmz V589 = IRAS 21582+6345 = GSC 4270.00614.
V628 Cep = 761302 = Tmz V645 = IRAS 21586+6037 = GSC 4263.00957.
V629 Cep = 761303 = Tmz V699 = IRAS 21586+5538 = GSC 3973.00833.
V630 Cep = 761304 = Tmz V553 = IRAS 21592+6745 = GSC 4463.03116.
V631 Cep = 761305 = Tmz V592 = IRAS 21593+6449 = GSC 4271.01580.
V632 Cep = 761306 = Tmz V658 = IRAS 21594+5811 = GSC 3981.00553.
V633 Cep = 761309 = Tmz V644 = IRAS 22002+6103 = GSC 4263.01060.
V634 Cep = 761310 = Tmz V594 = IRAS 22011+6558 = GSC 4275.02101.
V635 Cep = 761311 = Tmz V694 = IRAS 22011+5635 = GSC 3977.01290.
V636 Cep = 761313 = Mis V0529 = IRAS 22023+5924 = GSC 3981.00504.
V637 Cep = 761314 = Tmz V720 = GSC 3973.01053.
V638 Cep = 761315 = Tmz V552 = IRAS 22032+6825 = GSC 4463.01137.
V639 Cep = 761316 = Mis V0363.
V640 Cep = 761318 = Tmz V665 = IRAS 22043+6045 = GSC 4263.01520.
V641 Cep = 761319 = Tmz V700 = IRAS 22043+5527 = GSC 3973.01441.
V642 Cep = 761320 = Tmz V659 = GSC 3981.01555.
V643 Cep = 761321 = Tmz V661 = IRAS 22044+5900 = GSC 3981.01354.
V644 Cep = 761322 = Tmz V662 = IRAS 22044+5924 = GSC 3981.00474.
V645 Cep = 761323 = Tmz V663 = IRAS 22049+5926 = GSC 3981.00064.
V646 Cep = 761324 = Tmz V664 = IRAS 22071+6057 = CCS-II 5590 = GSC 4263.01408.
V647 Cep = 761325 = Tmz V719 = IRAS 22070+5500 = GSC 3973.02756.
V648 Cep = 761326 = Tmz V701 = IRAS 22077+5517 = GSC 3973.01924.
V649 Cep = 761327 = Tmz V666 = IRAS 22081+6054 = GSC 4263.01284.
V650 Cep = 761328 = Tmz V702 = IRAS 22106+5530 = CCS 3117 = CCS-II 5601 = GSC 3973.02116.
V651 Cep = 761329 = Tmz V688 = IRAS 22112+5931 = GSC 3981.00826.
V652 Cep = 761331 = Tmz V687 = IRAS 22125+5907 = GSC 3994.00351.
V653 Cep = 761334 = Tmz V691 = IRAS 22133+5837 = GSC 3994.01443.
V654 Cep = 761336 = Tmz V685 = IRAS 22134+5731 = GSC 3990.00527.
V655 Cep = 761338 = Tmz V686 = IRAS 22136+5717 = GSC 3990.00793.
V656 Cep = 761339 = Tmz V684 = IRAS 22155+5743 = GSC 3990.00054.
V657 Cep = 761340 = Tmz V596 = IRAS 22163+6221 = GSC 4268.00815.
V658 Cep = 761341 = Tmz V703 = IRAS 22163+5646 = GSC 3990.01590.
V659 Cep = 761342 = Tmz V554 = IRAS 22169+6724 = GSC 4463.01148.
V660 Cep = 761343 = Tmz V690 = IRAS 22173+5929 = CCS-II 5630 = GSC 3994.00717.
V661 Cep = 761344 = Tmz V540 = IRAS 22198+6912 = GSC 4467.00049.

Table 2 (continued)

V662	Cep =	761346	= Tmz V669 = IRAS 22197+6028 = CSS 704 = CSS-II 1296 = GSC 4264.00460.
V663	Cep =	761347	= Tmz V682 = IRAS 22211+5821 = GSC 3994.00911.
V664	Cep =	761348	= Tmz V681 = IRAS 22220+5829 = CCS 3129 = CCS-II 5650 = GSC 3994.00802.
V665	Cep =	761349	= Tmz V539 = IRAS 22236+6905 = GSC 4476.00158.
V666	Cep =	761350	= Tmz V672 = IRAS 22234+5923 = GSC 3994.00640.
V667	Cep =	761351	= Tmz V670 = IRAS 22240+6036 = GSC 4264.00749.
V668	Cep =	761352	= Tmz V683 = IRAS 22240+5808 = GSC 3994.01403.
V669	Cep =	761353	= Tmz V671 = IRAS 22248+6058 = GSC 4264.00935.
V670	Cep =	761354	= Tmz V597 = IRAS 22257+6413 = GSC 4272.01035.
V671	Cep =	761355	= Tmz V680 = IRAS 22256+5826 = GSC 3995.00095.
V672	Cep =	761356	= Tmz V673 = IRAS 22256+5910 = GSC 3995.00358.
V673	Cep =	761357	= Tmz V707 = IRAS 22263+5732 = GSC 3991.00099.
V674	Cep =	761358	= Tmz V676 = IRC+60355 = AFGL 2910 = IRAS 22264+5858 = GSC 3995.00224.
V675	Cep =	761359	= Tmz V710 = IRAS 22267+6012 = GSC 4264.00895.
V676	Cep =	761360	= Tmz V679 = IRAS 22269+5816 = GSC 3995.00279.
V677	Cep =	761361	= Tmz V708 = IRAS 22270+5745 = GSC 3991.02805.
V678	Cep =	761362	= Tmz V705 = IRAS 22273+5640 = GSC 3991.00257.
V679	Cep =	761363	= Tmz V674 = IRAS 22278+5914 = GSC 3995.00153.
V680	Cep =	761364	= Tmz V598 = IRAS 22281+6504 = GSC 4272.00298.
V681	Cep =	761365	= Tmz V704 = IRAS 22281+5647 = GSC 3991.00859.
V682	Cep =	761366	= Tmz V677 = IRAS 22298+5845 = GSC 3995.00763.
V683	Cep =	761367	= Tmz V706 = IRAS 22299+5644 = GSC 3991.03093.
V684	Cep =	761368	= Tmz V709 = IRAS 22301+5958 = GSC 4264.01075.
V685	Cep =	761369	= Tmz V675 = IRAS 22306+5918 = CCS 3141 = CCS-II 5678 = GSC 3995.00770.
V686	Cep =	761370	= Tmz V599 = IRAS 22318+6319 = GSC 4268.01115.
V687	Cep =	761371	= Tmz V601 = IRAS 22321+6303 = GSC 4268.01101.
V688	Cep =	761372	= Tmz V678 = IRAS 22322+5843 = GSC 3995.00940.
V689	Cep =	761373	= Tmz V600 = IRAS 22324+6317 = CCS 3142 = CCS-II 5684 = GSC 4268.01228.
V690	Cep =	761374	= Tmz V556 = IRAS 22327+6739 = GSC 4476.01249.
V691	Cep =	761375	= Tmz V555 = IRAS 22329+6744 = GSC 4476.01423.
V692	Cep =	761376	= Tmz V602 = IRAS 22360+6259 = GSC 4269.00698.
V693	Cep =	761377	= Tmz V603 = IRAS 22373+6501 = GSC 4273.00764.
V694	Cep =	761378	= Tmz V604 = IRAS 22378+6547 = GSC 4277.00495.
V695	Cep =	761379	= Tmz V557 = IRAS 22400+6744 = GSC 4476.01060.
V696	Cep =	761380	= Tmz V559 = IRAS 22416+6711 = GSC 4277.00262.
V697	Cep =	761381	= Tmz V558 = IRAS 22437+6742 = GSC 4476.00879.
V698	Cep =	761382	= GSC 3992.00847.
V699	Cep =	761383	= NSV 14312 = CSV 8792 = Weber 30 = GSC 3992.00731.
V700	Cep =	761384	= Tmz V561 = IRAS 22444+6647 = GSC 4477.00186.
V701	Cep =	761385	= Tmz V560 = IRAS 22457+6655 = GSC 4477.00909.
V702	Cep =	761399	= 4 (NGC 7762) = GSC 4479.00941.
EQ	Cet =	760023	= 1RXS J012851.9–233931 = RX J0128.8–2339 = RBS 0206.
ER	Cet =	760027	= Tmz V629 = GSC 5277.00022.
EE	Cha =	760787	= CoD–77°522 = CPD–77°766 = HD 104036 (A2) = HIP 058410 = SAO 256892 = PPM 371318 = GSC 9415.00770 = GSC 9415.02547 = GSC 9415.02675.
EF	Cha =	760790	= CoD–78°491 = CPD–78°727 = HD 105234 (A2) = HIP 059093 = SAO 256904 = PPM 371380 = GSC 9416.00926.
AQ	Col =	760142	= EC 05217–3914 = GSC 7595.01052.
AR	Col =	760426	= Tmz V099 = IRAS 06373–3319 = GSC 7091.01636.
LM	Com =	760792	= PG 1224+309.
LN	Com =	760797	= Tmz V627 = GSC 1454.00371.
V722	CrA =	761004	= Tmz V739 = IRAS 18027–4015 = GSC 7903.02743.
V723	CrA =	761026	= Tmz V740 = IRAS 18349–3856 = GSC 7902.01896.
V724	CrA =	761027	= HD 171983 (Ma) = Tmz V738 = IRAS 18359–3828 = GSC 7902.01497.
V725	CrA =	761029	= Tmz V737 = IRAS 18370–3822 = GSC 7915.01273.

Table 2 (continued)

V726	CrA =	761031	= NSV 11261 = BV 867 = Had V20 = IRAS 18409–4344 = GSC 7927.01130.
V727	CrA =	761042	= Had V19 = GSC 7928.02234.
AK	CrB =	760829	= Tmz V050 = IRAS 15541+3715 = GSC 2578.00660.
WX	Crt =	760780	= Had V36 = GSC 5503.01061.
DX	Cru =	760789	= New var in Crux.
DY	Cru =	760794	= NSV 19481 = IRAS 12444–5925 = CCS 2031 = CCS-II 3284 = GSC 8659.01394.
V2213	Cyg =	761109	= Var near V1504 Cyg.
V2214	Cyg =	761112	= KPD 1930+2752.
V2215	Cyg =	761114	= No.6 near V798 Cyg.
V2216	Cyg =	761115	= No.8 near V798 Cyg.
V2217	Cyg =	761126	= IRAS 19450+3416.
V2218	Cyg =	761131	= Mis V0175 = IRAS 19550+3401.
V2219	Cyg =	761132	= Mis V0732.
V2220	Cyg =	761134	= Mis V0738 = CCS-II 4580.
V2221	Cyg =	761135	= Mis V0173 = IRAS 19557+3038.
V2222	Cyg =	761136	= Mis V0670.
V2223	Cyg =	761137	= Mis V0695 = IRAS 19559+3137.
V2224	Cyg =	761138	= Mis V0392.
V2225	Cyg =	761139	= Mis V0149 = IRAS 19561+2958.
V2226	Cyg =	761140	= Mis V0354.
V2227	Cyg =	761143	= Mis V0343 = IRAS 19578+3644.
V2228	Cyg =	761144	= Mis V0724 = IRAS 19579+2926.
V2229	Cyg =	761145	= Mis V0680.
V2230	Cyg =	761146	= Mis V0360 = CCS-II 4603.
V2231	Cyg =	761147	= Mis V0710.
V2232	Cyg =	761148	= 20010+3011 = 38-09441.
V2233	Cyg =	761149	= Mis V0344 = IRAS 19592+3101.
V2234	Cyg =	761150	= Mis V0734.
V2235	Cyg =	761151	= Mis V0393.
V2236	Cyg =	761152	= Mis V0733.
V2237	Cyg =	761153	= Mis V0689 = IRAS 20007+3033.
V2238	Cyg =	761154	= GSC 2683.03076.
V2239	Cyg =	761158	= GSC 3151.02126.
V2240	Cyg =	761159	= GSC 2684.01255.
V2241	Cyg =	761160	= V5 (IC 4996).
V2242	Cyg =	761161	= V4 (IC 4996).
V2243	Cyg =	761162	= V2 (IC 4996).
V2244	Cyg =	761163	= V1 (IC 4996). Probable cluster nonmember.
V2245	Cyg =	761167	= NSV 25130 = BD+40°4147 = HD 229196 (B) = HIP 100542 = SAO 049559 = PPM 059833 = Star 3 (NGC 6910) = GSC 3156.01600.
V2246	Cyg =	761168	= EXO 2030+375.
V2247	Cyg =	761170	= GSC 2695.01350.
V2248	Cyg =	761173	= Mis V0345 = IRAS 20583+3928.
V2249	Cyg =	761174	= Mis V0106. In 52" to SE from NSV 25425.
V2250	Cyg =	761179	= IRC+50362 = AFGL 2720 = IRAS 21086+5238.
V2251	Cyg =	761181	= Var 3 in the field of EUVE J2114+503.
V2252	Cyg =	761205	= Tmz V733 = IRAS 21311+5426 = GSC 3970.00321.
V2253	Cyg =	761206	= NSV 25669 = SVS 2368 = LD 58 = IRAS 21308+3908.
V2254	Cyg =	761210	= Tmz V732 = IRAS 21335+5453 = GSC 3971.00728.
V2255	Cyg =	761212	= Tmz V731 = IRAS 21348+5502 = CCS-II 5377 = GSC 3971.02185.
V2256	Cyg =	761213	= BD+33°4307 = HD 205798 (F0) = HIP 106708 = SAO 071525 = PPM 086800 = GSC 2721.02079.
V2257	Cyg =	761216	= Tmz V730 = IRAS 21354+5442 = GSC 3971.00118.
V2258	Cyg =	761225	= Tmz V729 = IRAS 21383+5425 = GSC 3971.00296.
V2259	Cyg =	761234	= Tmz V728 = 18 [273] = IRAS 21404+5444 = GSC 3971.00294. In a dark cloud.
V2260	Cyg =	761236	= Tmz V727 = GSC 3971.00194.
V2261	Cyg =	761238	= 9 (NGC 7128) = Hoag 11p (NGC 7128) = GSC 3967.00316.
V2262	Cyg =	761239	= 27 (NGC 7128) = GSC 3967.02562.

Table 2 (continued)

V2263	Cyg =	761240	= 29 (NGC 7128) = Hoag 6p (NGC 7128) = GSC 3967.00690.
V2264	Cyg =	761241	= 51 (NGC 7128) = Hoag 34p (NGC 7128).
V2265	Cyg =	761254	= Tmz V726 = IRAS 21452+5440 = GSC 3972.02626.
V2266	Cyg =	761257	= Tmz V725 = IRAS 21467+5508 = GSC 3972.02329.
V2267	Cyg =	761266	= Tmz V724 = IRAS 21510+5503 = GSC 3972.01800.
V2268	Cyg =	761271	= Tmz V723 = IRAS 21530+5501 = GSC 3972.00943.
V2269	Cyg =	761287	= Tmz V722 = IRAS 21562+5448 = GSC 3972.02642.
V2270	Cyg =	761291	= Mis V0527 = IRAS 21566+5051 = CCS-II 5525.
V2271	Cyg =	761294	= Mis V0368.
V2272	Cyg =	761296	= Tmz V721 = IRAS 21574+5453 = GSC 3972.00416.
V2273	Cyg =	761301	= Mis V0528 = IRAS 21581+5035.
NV	Del =	761165	= Be V24 = GSC 1078.00852.
NW	Del =	761169	= Tmz V744 = IRAS 20444+0540.
NX	Del =	761171	= Tmz V742 = IRC+10479 = AFGL 2662 = IRAS 20479+0554 = GSC 0524.01806.
AZ	Dor =	760359	= BS 1960 = HD 37935 (A0) = HIP 026368 = CoD–66°337 = CPD–66°439 = SAO 249322 = PPM 354869 = GSC 8891.00846.
KU	Dra =	760795	= Tmz V358 = GSC 4169.00183.
KV	Dra =	760811	= FBS 1449+642 = RX J1450.5+6403.
KW	Dra =	760823	= Tmz V331 = IRAS 15299+5254 = GSC 3869.00571.
KX	Dra =	760826	= PG 1541+650.
KY	Dra =	761044	= Tmz V359 = IRAS 18578+6344 = GSC 4224.00992.
KZ	Dra =	761157	= Tmz V131 = GSC 4446.01025.
SZ	Equ =	761177	= Be V26 = GSC 1108.02511.
TT	Equ =	761180	= Be V25 = IRAS 21079+1023 = GSC 1108.00961.
TU	Equ =	761189	= Tmz V745 = IRAS 21213+0613 = GSC 0541.01533.
HX	Eri =	760049	= Tmz V625 = GSC 5868.00786.
HY	Eri =	760130	= RX J0501.7–0359 = 1RXS J050146.2–035927.
V354	Gem =	760376	= Tmz V260 = IRAS 06018+2746 = CSS 130 = CSS-II 183 = GSC 1872.01811.
V355	Gem =	760452	= Tmz V716 = IRAS 06575+2612 = GSC 1899.00620.
V356	Gem =	760463	= NSV 17387 = BD+24°1576 = BS 2722 = HD 55579 (B9) = HIP 034995 = SAO 079191 = PPM 097232 = IDS 0708.3N2453A = GSC 1900.00108.
V357	Gem =	760484	= Tmz V298 = IRAS 07216+1440 = GSC 0776.00274.
V358	Gem =	760496	= Tmz V297 = IRAS 07248+1820 = GSC 1351.00532.
V359	Gem =	760501	= Tmz V300 = IRAS 07275+2243 = GSC 1910.01357.
V360	Gem =	760533	= NSV 17556 = TASV 0739+15 = Q 1990/015 = Tmz V299 = IRAS 07392+1527 = GSC 1361.00794.
V361	Gem =	760536	= Tmz V301 = IRAS 07397+2316 = GSC 1912.00720.
V362	Gem =	760557	= Tmz V379 = IRAS 07505+1436 = GSC 0791.00444.
V363	Gem =	760572	= Tmz V512 = IRAS 07538+3156 = GSC 2467.00356.
V364	Gem =	760584	= Tmz V515 = IRAS 07585+2909 = GSC 1938.01158.
V365	Gem =	760594	= Tmz V514 = IRAS 08014+2814 = GSC 1934.00649.
DQ	Gru =	761389	= NSV 26072 = BS 8895A = HD 220392 (A5) = HIP 115510 = CoD–54°9528 = CPD–54°10281 = SAO 247854 = PPM 351034 = IDS 2318.2S5381A = IRAS 23210–5405 = GSC 8831.01481.
V1012	Her =	760846	= Tmz V049 = IRAS 16037+4218 = GSC 3064.00040.
V1013	Her =	760851	= Be V14 = GSC 0959.01397.
V1014	Her =	760867	= Tmz V236 = IRAS 16573+2310 = GSC 2059.00219.
V1015	Her =	760904	= IRAS 17506+3411.
V1016	Her =	761013	= Tmz V033 = IRAS 18147+1558 = GSC 1568.00727.
V1017	Her =	761015	= NSV 24410 = BD+18°3650 = HD 348533 (A0) = HIP 089972 = PPM 134601 = CCDM 18214+1810 = GSC 1572.01622.
V1018	Her =	761018	= Yamamoto 1829+14 = IRAS 18274+1405 = GSC 1035.00024.
V1019	Her =	761033	= Tmz V055 = IRAS 18434+1558 = GSC 1583.01538.
V1020	Her =	761040	= Mis V0685 = IRAS 18554+1333.
V362	Hya =	760627	= Tmz V400 = IRAS 08116–0829 = GSC 5426.02334.
V363	Hya =	760630	= Tmz V396 = IRAS 08127–0418.
V364	Hya =	760644	= Tmz V390 = IRAS 08189–0024 = GSC 4848.01821.
V365	Hya =	760646	= Tmz V399 = IRAS 08194–0930 = IRC–10192 = GSC 5431.00645.
V366	Hya =	760675	= Tmz V494 = IRAS 08321–1629 = GSC 6011.01614.
V367	Hya =	760677	= Tmz V498 = IRAS 08327–1711 = GSC 6015.00023.

Table 2 (continued)

V368	Hya =	760679	= Tmz V495 = IRAS 08333–1625 = GSC 6011.00650.
V369	Hya =	760681	= Tmz V497 = IRAS 08341–1551 = GSC 6011.00154.
V370	Hya =	760682	= BD–15°2522 = PPM 220372 = Tmz V496 = IRAS 08349–1611 = GSC 6011.01554.
V371	Hya =	760686	= NSV 04189 = IRAS 08380–1438 = IRC–10202.
V372	Hya =	760694	= BD–18°2504 = PPM 220719 = Tmz V491 = IRAS 08495–1858 = GSC 6021.00090.
V373	Hya =	760695	= Tmz V492 = IRAS 08503–1902 = GSC 6021.01245.
V374	Hya =	760697	= Tmz V489 = GSC 6018.00369.
V375	Hya =	760698	= Tmz V488 = IRAS 08579–1727 = GSC 6018.01367.
V376	Hya =	760699	= BD–16°2661 = Tmz V487 = IRAS 08579–1636 = GSC 6014.00570.
V377	Hya =	760700	= Tmz V490 = IRAS 08585–1519 = GSC 6014.01003.
V378	Hya =	760702	= Tmz V486 = IRAS 08592–1656 = GSC 6018.01158.
V379	Hya =	760712	= Tmz V536 = IRAS 09043–1906 = GSC 6035.00910.
V380	Hya =	760720	= Tmz V485 = IRAS 09073–1728 = GSC 6031.01076.
V381	Hya =	760723	= BD–22°2527 = CoD–22°6993= CPD–22°4104 = Tmz V531 = IRAS 09105–2309 = GSC 6587.00745.
V382	Hya =	760724	= Tmz V534 = IRAS 09110–1455 = GSC 6028.00658.
V383	Hya =	760725	= Tmz V535 = IRAS 09116–1734 = GSC 6032.01563.
V384	Hya =	760734	= Tmz V530 = IRAS 09151–2235 = GSC 6587.01138.
V385	Hya =	760738	= BD–21°2816 = CPD–21°4342 = Tmz V532 = IRAS 09273–2152 = GSC 6042.00824.
V386	Hya =	760739	= Tmz V517 = IRAS 09287–2328 = GSC 6601.01867.
V387	Hya =	760740	= Tmz V538 = IRAS 09310–1953.
V388	Hya =	760741	= Tmz V537 = IRAS 09316–1942 = GSC 6038.01078.
V389	Hya =	760742	= Tmz V533 = IRAS 09324–2139 = GSC 6042.01432.
CV	Hyi =	760026	= RX J0132.7–6554.
CF	Ind =	761223	= NSV 25710 = CoD–52°9942 = CPD–52°11910 = HD 205847 (F0) = HIP 106954 = SAO 247123 = PPM 349574 = GSC 8436.00522.
V434	Lac =	761330	= Tmz V718 = IRAS 22113+5422 = GSC 3973.00069.
V435	Lac =	761332	= 469 (NGC 7245).
V436	Lac =	761333	= 456 (NGC 7245).
V437	Lac =	761335	= 493 (NGC 7245).
V438	Lac =	761337	= 417 (NGC 7245). Probably a cluster background variable.
V439	Lac =	761345	= Tmz V717 = GSC 3982.00300.
V440	Lac =	761386	= NSV 14365 = CSV 5632 = S 4622.
GK	Leo =	760782	= Tmz V735 = GSC 1980.02234.
GL	Leo =	760785	= 2MASSW J1145572+231730.
WX	LMi =	760747	= HS 1023+3900.
AD	Lep =	760140	= Tmz V635 = IRAS 05195–1558 = GSC 5915.01625.
AE	Lep =	760373	= BD–14°1319 = PPM 216655 = AS 117 = IRAS 06013–1452 = GSC 5361.01651.
KL	Lib =	760810	= BD–00°2884 = HD 130484 (F2) = HIP 072428 = SAO 140148 = PPM 179391 = GSC 4986.00400.
KM	Lib =	760814	= Tmz V230 = IRAS 15056–0258 = GSC 5005.00096.
KN	Lib =	760821	= NSV 07109 = CSV 2352 = HV 10670 = GSC 5603.00074.
KO	Lib =	760822	= Tmz V637 = GSC 6196.01320.
KP	Lib =	760824	= NSV 07180 = CSV 2403 = HV 10695 = GSC 5604.00200.
NR	Lup =	760831	= CoD–32°11262 = Tmz V335 = IRAS 15533–3309 = GSC 7333.00863.
NS	Lup =	760832	= Tmz V336 = IRAS 15534–3307 = GSC 7333.01771.
DK	Lyn =	760401	= Tmz V238 = IRAS 06155+5716 = GSC 3772.01599.
DL	Lyn =	760408	= Tmz V241 = IRAS 06211+5744 = GSC 3772.00663.
DM	Lyn =	760451	= Tmz V237 = IRAS 06453+5914 = GSC 3778.00184.
DN	Lyn =	760505	= Tmz V081 = IRAS 07280+4739 = GSC 3409.02341.
DO	Lyn =	760542	= NSV 17583 = BD+39°2001 = HD 62454 (F0) = HIP 037863 = SAO 060320 = PPM 073088 = GSC 2963.01475.
DP	Lyn =	760546	= Tmz V024 = GSC 3795.01847.
DQ	Lyn =	760654	= NSV 17869 = 6/RR VII [085] = GSC 2482.00005.
DR	Lyn =	760656	= Tmz V023 = GSC 3421.02216.
DS	Lyn =	760713	= Tmz V088 = GSC 2498.00610.
DT	Lyn =	760728	= PG 0911+456 = GSC 3424.01387.

Table 2 (continued)

V562 Lyr = 761021 = LD 345 = GSC 3530.02757.
V563 Lyr = 761032 = NSV 11321 = BD+40°3480 = S 9331 = GSC 3122.00495.
V564 Lyr = 761100 = No.112 (NGC 6791).
V565 Lyr = 761101 = V18 (NGC 6791).
V566 Lyr = 761102 = V19 (NGC 6791).
V567 Lyr = 761103 = V20 (NGC 6791). The equatorial coordinates in the Table A1 in [207] refer to V21.
V568 Lyr = 761104 = V21 (NGC 6791). The equatorial coordinates in the Table A1 in [207] refer to V20.
V791 Mon = 760371 = BD–10°1351 = AS 116 = IRAS 05598–1000.
V792 Mon = 760372 = Tmz V279 = IRAS 06009–1003.
V793 Mon = 760380 = Tmz V266 = IRAS 06038–0541 = IRC–10109 = AFGL 873.
V794 Mon = 760387 = Tmz V278 = IRAS 06092–1001 = GSC 5366.01452.
V795 Mon = 760389 = Tmz V277 = IRAS 06114–1018 = GSC 5366.02269.
V796 Mon = 760395 = Tmz V276 = IRAS 06146–0834.
V797 Mon = 760403 = Tmz V262 = IRAS 06183–0209.
V798 Mon = 760407 = Tmz V265 = IRAS 06228–0244.
V799 Mon = 760409 = Tmz V271 = IRAS 06233–0050 = CCS 511 = CCS-II 1270 = GSC 4785.01707.
V800 Mon = 760411 = Tmz V264 = IRAS 06241–0203 = GSC 4789.00622.
V801 Mon = 760412 = Tmz V272 = IRAS 06245–0453.
V802 Mon = 760413 = Tmz V280 = IRAS 06256–1055 = CCS 518 = CCS-II 1283.
V803 Mon = 760427 = VVO 20B (NGC 2264) = Penn 284 (NGC 2264) = GSC 0750.01709.
V804 Mon = 760428 = VVO 31B (NGC 2264).
V805 Mon = 760429 = NSV 03092 = VVO 51B (NGC 2264) = Penn 321 (NGC 2264).
V806 Mon = 760431 = NSV 03112 = VVO 35A (NGC 2264) = Penn 388 (NGC 2264).
V807 Mon = 760432 = NSV 03116 = CSV 6479 = VVO 25C (NGC 2264) = W 150 (NGC 2264).
V808 Mon = 760433 = VVO 31D (NGC 2264).
V809 Mon = 760434 = NSV 17078 = VVO 23C (NGC 2264) = ASS 535 (NGC 2264).
V810 Mon = 760435 = VVO 27A (NGC 2264) = Penn 406 (NGC 2264) = GSC 0750.01363.
V811 Mon = 760436 = VVO 28A (NGC 2264) = Penn 407 (NGC 2264).
V812 Mon = 760437 = VVO 41C (NGC 2264) = W 160 (NGC 2264).
V813 Mon = 760438 = VVO 4A (NGC 2264) = Penn 403 (NGC 2264).
V814 Mon = 760439 = NSV 03124 = VVO 27D (NGC 2264) = Penn 402 (NGC 2264).
V815 Mon = 760440 = VVO 9D (NGC 2264).
V816 Mon = 760441 = NSV 03127 = VVO 16D (NGC 2264) = Penn 415 (NGC 2264).
V817 Mon = 760442 = VVO 12A (NGC 2264) = Penn 427 (NGC 2264).
V818 Mon = 760443 = NSV 03132 = VVO 24D (NGC 2264) = Penn 425 (NGC 2264).
V819 Mon = 760444 = VVO 37D (NGC 2264).
V820 Mon = 760445 = NSV 03139 = VVO 8A (NGC 2264) = Penn 435 (NGC 2264).
V821 Mon = 760446 = NSV 17116 = VVO 1D (NGC 2264) = ASS 344 (NGC 2264).
V822 Mon = 760468 = Tmz V306 = IRAS 07164–0758 = GSC 5395.02083.
V823 Mon = 760479 = Tmz V309 = IRAS 07199–0950 = CCS 733 = CCS-II 1676 = GSC 5399.01531.
V824 Mon = 760480 = Tmz V305 = IRAS 07203–0843.
V825 Mon = 760485 = Tmz V296 = HS 336 [259] = IRAS 07220–0050 = CCS 748 = CCS-II 1697.
V826 Mon = 760497 = Tmz V295 = HS 318 [259] = IRAS 07259–0038.
V827 Mon = 760498 = BD–08°1937 = HD 59435 (A5) = HIP 036419 = SAO 134747 = PPM 190323 = GSC 5396.02217.
V828 Mon = 760502 = Tmz V302 = IRAS 07292–1055 = GSC 5400.00111.
V829 Mon = 760525 = Tmz V307 = IRAS 07372–1036.
V830 Mon = 760556 = Tmz V294 = IRAS 07502–0459 = CSS-II 419 = GSC 4841.00278.
V831 Mon = 760574 = Tmz V386 = HS 434 [259] = IRAS 07551–0032 = CCS 961 = CCS-II 1960 = GSC 4833.00939.
V832 Mon = 760577 = Tmz V393 = IRAS 07562–0654 = GSC 4845.01254.
V833 Mon = 760593 = Tmz V395 = IRAS 08019–0259 = CCS 1016 = CCS-II 2028.
V834 Mon = 760596 = Tmz V401 = IRAS 08030–0932 = GSC 5417.00694.
V835 Mon = 760599 = Tmz V392 = IRAS 08040–0417 = GSC 4854.02212.
V836 Mon = 760607 = Tmz V406 = IRAS 08055–1020 = GSC 5417.01481.
V837 Mon = 760611 = Tmz V394 = IRAS 08058–0056 = GSC 4847.02199.

Table 2 (continued)

V381 Nor = 760827 = XTE J1550–564.
V2503 Oph = 760852 = NSV 07695 = Haro 1-4 = Do-Ar 16 = HBC 257 = IRAS 16221–2312.
V2504 Oph = 760853 = Tmz V636 = GSC 5626.00105.
V2505 Oph = 760854 = NTTS 162649–2145= Sco PMS 214 = GSC 6215.00184.
V2506 Oph = 760856 = Tmz V367 = IRAS 16431–0207 = GSC 5054.00790.
V2507 Oph = 760858 = NSV 20773 = Wa Oph/4 = HBC 652 = GSC 5641.00493.
V2508 Oph = 760859 = NSV 20775 = He-3 1258 = Wa Oph/6 = HBC 653 = IRAS 16459–1411 = GSC 5641.00306.
V2509 Oph = 760860 = Be V15 = GSC 0396.01710.
V2510 Oph = 760861 = Had V11 = IRAS 16504–2022.
V2511 Oph = 760862 = Had V42 = IRAS 16534–2026.
V2512 Oph = 760863 = Mis V0279 = IRAS 16544–1246.
V2513 Oph = 760864 = Mis V0822 = IRAS 16554–2019.
V2514 Oph = 760865 = Mis V0280 = IRAS 16559–1239 = GSC 5651.01718.
V2515 Oph = 760866 = Mis V0310 = GSC 5651.01814.
V2516 Oph = 760868 = Mis V0889.
V2517 Oph = 760869 = Mis V0829 = IRAS 16577–2857.
V2518 Oph = 760870 = Mis V0823 = IRAS 16579–2245.
V2519 Oph = 760871 = Mis V0910.
V2520 Oph = 760872 = Mis V0909.
V2521 Oph = 760873 = Mis V0567 = IRAS 17001–2029.
V2522 Oph = 760874 = NSV 08220 = CSV 2962 = HV 3936 = BV 1691 = Prager 1188 = Terzan 669 = IRAS 17050–2749.
V2523 Oph = 760875 = NSV 08226 = He-3 1341 = GSC 6237.00636.
V2524 Oph = 760876 = NSV 08267 = BV 1695 = Terzan 785 = IRAS 17087–2635 = GSC 6820.00294.
V2525 Oph = 760877 = Had V56.
V2526 Oph = 760879 = NSV 21466 = Terzan 1141.
V2527 Oph = 760880 = Oph 2 [005] = 1E 1719.1–1946.
V2528 Oph = 760882 = Tmz V741.
V2529 Oph = 760883 = Had V53 = GSC 6239.01183.
V2530 Oph = 760885 = NSV 09100 = CSV 3244 = HV 10963 = GSC 0992.01096.
V2531 Oph = 760887 = Had V43 = GSC 6256.01625.
V2532 Oph = 760889 = Had V45.
V2533 Oph = 760935 = Had V16 = GSC 5091.00396.
V2534 Oph = 760956 = Mis V0347.
V2535 Oph = 761005 = Be V16 = IRAS 18050+0622.
V2536 Oph = 761008 = Be V7 = GSC 1009.00766.
V2537 Oph = 761014 = TASS J182113.5+002721 = IRAS 18186+0025.
V2538 Oph = 761022 = Be V10 = IRAS 18297+0804 = GSC 1024.02911.
V2539 Oph = 761025 = Be V11.
V1405 Ori = 760119 = KUV 0442+1416 = Kiso Area A-0685 No.10 = GSC 0695.01437.
V1406 Ori = 760125 = W71 = BD+15°705 = HD 286179 (G0) = RX J0457.0+1517 = GSC 1281.01215.
V1407 Ori = 760127 = W73 = BD+15°706 = HD 286178 (G5) = RX J0457.2+1524 = GSC 1281.01288.
V1408 Ori = 760137 = Be V33 = IRAS 05121+1007 = GSC 0703.00625.
V1409 Ori = 760145 = NSV 02041 = CSV 102474 = HD 244314 (A2) = BD+11°829 = IRAS 05275+1118 = GSC 0709.01217.
V1410 Ori = 760147 = HD 244604 (A3) = BD+11°838 = SAO 094626 = PPM 121065 = IRAS 05291+1115 = GSC 0709.00030.
V1411 Ori = 760149 = No. 0169.
V1412 Ori = 760150 = No. 0190.
V1413 Ori = 760151 = No. 0210 = Par 1308.
V1414 Ori = 760152 = No. 0267.
V1415 Ori = 760153 = No. 0273.
V1416 Ori = 760155 = No. 0316 = Par 1335.
V1417 Ori = 760156 = No. 0327.
V1418 Ori = 760157 = No. 0340.
V1419 Ori = 760158 = No. 0349.

Table 2 (continued)

V1420 Ori = 760159 = No. 0360.
V1421 Ori = 760160 = No. 0456.
V1422 Ori = 760161 = No. 0507.
V1423 Ori = 760162 = No. 0519.
V1424 Ori = 760163 = No. 0539.
V1425 Ori = 760164 = NSV 02185 = CSV 6209 = No. 0543 [044] = TSN 102 [045] = Haro 4-167 = Kiso Area A-0976 No.81.
V1426 Ori = 760165 = No. 0607.
V1427 Ori = 760166 = No. 0614 [044] = H 3151 = Par 1417 [046].
V1428 Ori = 760167 = No. 0674.
V1429 Ori = 760168 = No. 0748.
V1430 Ori = 760169 = No. 0786.
V1431 Ori = 760170 = No. 0812 [044] = JW 3 [047].
V1432 Ori = 760171 = NSV 02202 = No. 0817 [044] = JW 4 [047] = Par 1483.
V1433 Ori = 760172 = No. 0832.
V1434 Ori = 760173 = NSV 02200 = No. 0839 [044] = Par 1476 [046].
V1435 Ori = 760174 = NSV 02205 = CSV 6216 = No. 0852 [044] = JW 15 [047] = Rosino E2.
V1436 Ori = 760175 = No. 0880.
V1437 Ori = 760176 = No. 0939.
V1438 Ori = 760177 = No. 0975 [044] = JW 39 [047].
V1439 Ori = 760178 = NSV 02213 = SVS 1492 = No. 1019 [044] = Par 1534 [046] = GSC 4774.00420.
V1440 Ori = 760179 = NSV 02218 = CSV 6224 = No. 1089 [044] = Rosino 52 = Par 1547 [046].
V1441 Ori = 760180 = No. 1093 [044] = JW 63 [047] = Par 1569.
V1442 Ori = 760181 = No. 1121.
V1443 Ori = 760182 = NSV 02222 = CSV 100551 = No. 1126 [044] = Par 1567 [046] = Prager 0225.
V1444 Ori = 760183 = JW 75 = Par 1587 = GSC 4774.00860.
V1445 Ori = 760184 = JW 76.
V1446 Ori = 760185 = No. 1158 [044] = JW 77 [047] = Par 1595.
V1447 Ori = 760186 = No. 1157.
V1448 Ori = 760187 = No. 1161 [044] = Par 1583 [046].
V1449 Ori = 760188 = No. 1171 [044] = JW 83 [047].
V1450 Ori = 760189 = No. 1219 [044] = JW 95 [047] = Par 1612.
V1451 Ori = 760190 = No. 1220 [044] = Par 1603 [046].
V1452 Ori = 760191 = No. 1237.
V1453 Ori = 760192 = Be V32 = GSC 0705.00921.
V1454 Ori = 760193 = NSV 02244 = CSV 100557 = JW 116 = Par 1633 = Prager 0230.
V1455 Ori = 760194 = No. 1279 [044] = JW 120 [047].
V1456 Ori = 760195 = No. 1292.
V1457 Ori = 760196 = No. 1299.
V1458 Ori = 760197 = No. 1308 [044] = JW 128 [047].
V1459 Ori = 760198 = JW 133.
V1460 Ori = 760199 = NSV 02248 = CSV 6237 = JW 135 = Rosino E10.
V1461 Ori = 760200 = No. 1325 [044] = JW 138 [047].
V1462 Ori = 760201 = NSV 16373 = No. 1354 [044] = JW 144 [047].
V1463 Ori = 760202 = NSV 16374 = No. 1357 [044] = JW 148 [047].
V1464 Ori = 760203 = No. 1368 [044] = JW 149 [047].
V1465 Ori = 760204 = No. 1385 [044] = Par 1655 [046].
V1466 Ori = 760205 = JW 159.
V1467 Ori = 760206 = No. 1407.
V1468 Ori = 760207 = No. 1413.
V1469 Ori = 760208 = No. 1426 [044] = JW 169 [047].
V1470 Ori = 760209 = No. 1428 [044] = JW 171 [047].
V1471 Ori = 760210 = No. 1434.
V1472 Ori = 760211 = No. 1452.
V1473 Ori = 760212 = No. 1453 [044] = JW 181 [047].
V1474 Ori = 760213 = NSV 16380 = No. 1474 [044] = JW 186 [047].
V1475 Ori = 760214 = NSV 16381 = No. 1485 [044] = JW 188 [047].
V1476 Ori = 760215 = No. 1496.

Table 2 (continued)

V1477 Ori = 760216 = No. 1501 [044] = JW 192 [047] = Par 1686.
V1478 Ori = 760217 = No. 1511 [044] = JW 196 [047].
V1479 Ori = 760218 = No. 1545 [044] = JW 211 [047].
V1480 Ori = 760219 = No. 1566 = H 3013.
V1481 Ori = 760220 = NSV 16393 = No. 1618 [044] = JW 239 [047] = Par 1725.
V1482 Ori = 760221 = No. 1627 [044] = JW 243 [047].
V1483 Ori = 760222 = JW 250.
V1484 Ori = 760223 = No. 1692 [044] = JW 280 [047].
V1485 Ori = 760224 = NSV 16406 = JW 315.
V1486 Ori = 760225 = No. 1797 = H 3134.
V1487 Ori = 760226 = JW 345 = Par 1783.
V1488 Ori = 760227 = JW 362.
V1489 Ori = 760228 = No. 1872.
V1490 Ori = 760229 = No. 1907 = Par 1812.
V1491 Ori = 760230 = NSV 02277 = CSV 6250 = No. 1944 [044] = Par 1781 [046] = Rosino S3.
V1492 Ori = 760231 = No. 1966 [044] = JW 383 [047].
V1493 Ori = 760232 = No. 2037 [044] = JW 416 [047].
V1494 Ori = 760233 = JW 417.
V1495 Ori = 760234 = No. 2057 [044] = JW 422 [047].
V1496 Ori = 760235 = JW 423 = Par 1819.
V1497 Ori = 760236 = NSV 02283 = CSV 6252 = No. 2119 [044] = Rosino D9 [052].
V1498 Ori = 760237 = No. 2121 [044] = JW 447 [047].
V1499 Ori = 760238 = NSV 02299 = CSV 6255 = No. 2169 [044] = TSN 227 [045] = Haro 4-191.
V1500 Ori = 760239 = No. 2168 [044] = JW 467 [047].
V1501 Ori = 760240 = NSV 16452 = JW 478 = Par 1872.
V1502 Ori = 760241 = No. 2246 [044] = JW 485 [047].
V1503 Ori = 760242 = No. 2256.
V1504 Ori = 760243 = JW 498 = Par 1873.
V1505 Ori = 760244 = No. 2301 [044] = JW 517 [047].
V1506 Ori = 760245 = No. 2318 [044] = Par 1900 [046].
V1507 Ori = 760246 = No. 2390.
V1508 Ori = 760247 = No. 2425 [044] = JW 545 [047].
V1509 Ori = 760248 = No. 2428 [044] = JW 550 [047].
V1510 Ori = 760249 = JW 553 [047] = Par 1911 [046].
V1511 Ori = 760250 = NSV 16476 = No. 2470 [044] = JW 579 [047].
V1512 Ori = 760251 = NSV 02300 = CSV 6256 = JW 576 = Rosino 25 = GR 18.
V1513 Ori = 760252 = No. 2510 = H 3140.
V1514 Ori = 760253 = NSV 16491 = No. 2654 [044] = JW 628 [047].
V1515 Ori = 760254 = NSV 02308 = CSV 6261 = No. 2667 [044] = JW 639 [047] = Par 1941.
V1516 Ori = 760255 = JW 636.
V1517 Ori = 760256 = JW 637 = Par 1939.
V1518 Ori = 760257 = No. 2698 [044] = JW 649 [047].
V1519 Ori = 760258 = No. 2703.
V1520 Ori = 760259 = NSV 16498 = JW 648 = Par 1960.
V1521 Ori = 760260 = No. 2713 [044] = JW 651 [047].
V1522 Ori = 760261 = NSV 16507 = No. 2744 [044] = JW 672 [047].
V1523 Ori = 760262 = JW 683 = Par 1975 = GSC 4774.00811.
V1524 Ori = 760263 = NSV 16510 = JW 681.
V1525 Ori = 760264 = JW 704.
V1526 Ori = 760265 = No. 2843 [044] = JW 719 [047].
V1527 Ori = 760266 = NSV 16517 = Par 1990 = JW 721.
V1528 Ori = 760267 = JW 727.
V1529 Ori = 760268 = No. 2876.
V1530 Ori = 760269 = NSV 16522 = No. 2913 [044] = JW 735 [047].
V1531 Ori = 760270 = No. 2918 [044] = JW 733 [047] = Par 1989.
V1532 Ori = 760271 = No. 2928.
V1533 Ori = 760272 = No. 3007 [044] = JW 778 [047].
V1534 Ori = 760273 = No. 3012.
V1535 Ori = 760274 = NSV 16531 = No. 3014 [044] = JW 771 [047] = Par 2007.
V1536 Ori = 760275 = No. 3029.

Table 2 (continued)

V1537 Ori = 760276 = NSV 02327 = CSV 6273 = No. 3028 [044] = JW 788 [047] = Rosino E28.
V1538 Ori = 760277 = No. 3032 [044] = JW 789 [047].
V1539 Ori = 760278 = NSV 02332 = CSV 100601 = No. 3088 [044] = JW 818 [047] = Par 2048.
V1540 Ori = 760279 = JW 817.
V1541 Ori = 760280 = No. 3097 [044] = JW 816 [047].
V1542 Ori = 760281 = JW 823.
V1543 Ori = 760282 = No. 3115 [044] = JW 822 [047].
V1544 Ori = 760283 = No. 3113.
V1545 Ori = 760284 = No. 3122 [044] = JW 828 [047].
V1546 Ori = 760285 = NSV 02339 = CSV 6278 = No. 3119 [044] = TSN 268 [045] = Haro 4-195 = Kiso Area A-0976 No.172.
V1547 Ori = 760286 = No. 3134 [044] = Par 2041 [046].
V1548 Ori = 760287 = No. 3142 [044] = JW 835 [047].
V1549 Ori = 760288 = No. 3146 [044] = Par 2070 [046].
V1550 Ori = 760289 = NSV 16546 = JW 836.
V1551 Ori = 760290 = No. 3152.
V1552 Ori = 760291 = No. 3161 [044] = JW 843 [047].
V1553 Ori = 760292 = No. 3177 [044] = Par 2079 [046].
V1554 Ori = 760293 = No. 3178 [044] = JW 848 [047].
V1555 Ori = 760294 = NSV 16553 = JW 863.
V1556 Ori = 760295 = No. 3205 [044] = Par 2088 [046].
V1557 Ori = 760296 = No. 3217 [044] = JW 864 [047].
V1558 Ori = 760297 = No. 3220 [044] = Par 2087 [046].
V1559 Ori = 760298 = JW 872.
V1560 Ori = 760299 = No. 3230.
V1561 Ori = 760300 = No. 3240 [044] = JW 878 [047].
V1562 Ori = 760301 = JW 880.
V1563 Ori = 760302 = No. 3263 [044] = JW 883 [047].
V1564 Ori = 760303 = No. 3259.
V1565 Ori = 760304 = JW 890 = Par 2097.
V1566 Ori = 760305 = NSV 02345 = CSV 6282 = No. 3288 [044] = TSN 276 [045] = Haro 4-022 = Kiso Area A-0976 No.181 = Par 2081.
V1567 Ori = 760306 = No. 3385.
V1568 Ori = 760307 = NSV 02354 = CSV 100609 = No. 3384 [044] = JW 926 [047] = Par 2134.
V1569 Ori = 760308 = No. 3397 [044] = JW 925 [047].
V1570 Ori = 760309 = No. 3404.
V1571 Ori = 760310 = JW 933.
V1572 Ori = 760311 = NSV 02353 = CSV 6285 = No. 3428 [044] = TSN 297 [045] = Haro 4-063 = Kiso Area A-0976 No.193.
V1573 Ori = 760312 = NSV 16567 = No. 3430 [044] = JW 935 [047].
V1574 Ori = 760313 = NSV 16568 = No. 3438 [044] = JW 943 [047].
V1575 Ori = 760314 = No. 3442 [044] = Par 2150 [046].
V1576 Ori = 760315 = No. 3447 [044] = JW 940 [047] = Par 2143.
V1577 Ori = 760316 = No. 3461 [044] = Par 2136 [046].
V1578 Ori = 760317 = No. 3465.
V1579 Ori = 760318 = No. 3501 [044] = Par 2155 [046].
V1580 Ori = 760319 = No. 3591 [044] = Par 2180 [046].
V1581 Ori = 760320 = No. 3668 [044] = JW 996 [047] = Par 2206.
V1582 Ori = 760321 = NSV 16576 = No. 3672 [044] = JW 1000 [047].
V1583 Ori = 760322 = No. 3678 [044] = JW 1004 [047].
V1584 Ori = 760323 = No. 3697.
V1585 Ori = 760324 = No. 3758.
V1586 Ori = 760325 = No. 3799.
V1587 Ori = 760326 = No. 3807 [044] = JW 1031 [047].
V1588 Ori = 760327 = NSV 02383 = CSV 100616 = Zinner 0452 = AN 84.1901 = No. 3828 [044] = Par 2268 [046].
V1589 Ori = 760328 = No. 3842.
V1590 Ori = 760329 = No. 3853.
V1591 Ori = 760330 = No. 3877.
V1592 Ori = 760331 = No. 3885 [044] = JW 1044 [047].
V1593 Ori = 760332 = No. 3891.

Table 2 (continued)

V1594	Ori =	760333	= No. 3896.
V1595	Ori =	760334	= NSV 02391 = No. 3907 [044] = SVS 1494 = Par 2306 [046].
V1596	Ori =	760335	= No. 3918 [044] = JW 1048 [047].
V1597	Ori =	760336	= No. 3993 [044] = Par 2322 [046].
V1598	Ori =	760337	= NSV 02402 = CSV 6312 = No. 4005 [044] = TSN 363 [045] = Haro 4-153 = Kiso Area A-0976 No.239 = Par 2332.
V1599	Ori =	760338	= No. 4046.
V1600	Ori =	760339	= No. 4047 [044] = H 5123.
V1601	Ori =	760340	= No. 4079.
V1602	Ori =	760341	= No. 4090 [044] = H 5162.
V1603	Ori =	760342	= No. 4112.
V1604	Ori =	760343	= No. 4163.
V1605	Ori =	760344	= No. 4173.
V1606	Ori =	760345	= No. 4226.
V1607	Ori =	760346	= No. 4307 [044] = Par 2384 [046] = GSC 4778.01067.
V1608	Ori =	760347	= No. 4338 = H 5065.
V1609	Ori =	760348	= No. 4341.
V1610	Ori =	760349	= No. 4358.
V1611	Ori =	760350	= No. 4360.
V1612	Ori =	760351	= NSV 02429 = CSV 6327 = No. 4418 [044] = H 5079 = TSN 396 [045] = Haro 4-105 = Par 2395.
V1613	Ori =	760352	= No. 4426 [044] = H 5078.
V1614	Ori =	760353	= No. 4446 [044] = H 5117.
V1615	Ori =	760354	= No. 4450.
V1616	Ori =	760355	= No. 4471.
V1617	Ori =	760356	= No. 4505.
V1618	Ori =	760357	= No. 4512 [044] = Par 2411 [046].
V1619	Ori =	760358	= No. 4576.
V1620	Ori =	760361	= Tmz V751 = IRAS 05412+1118 = GSC 0722.01129.
V1621	Ori =	760362	= Be V31 = GSC 0718.00685.
V1622	Ori =	760363	= Tmz V750 = IRAS 05429+0934.
V1623	Ori =	760367	= Be V4 = IRAS 05497+0620 = GSC 0128.01121.
V1624	Ori =	760370	= Mis V0741 = IRAS 05544+1945.
V1625	Ori =	760375	= Tmz V269 = IRAS 06018–0228 = GSC 4786.00342.
V1626	Ori =	760377	= Be V38 = GSC 0721.02377.
V1627	Ori =	760379	= Tmz V267 = IRAS 06036–0143 = GSC 4782.00885.
V1628	Ori =	760381	= Tmz V268 = IRAS 06038–0147 = GSC 4782.01182.
V1629	Ori =	760384	= Tmz V270 = IRAS 06060–0042 = GSC 4783.02583.
V1630	Ori =	760392	= Tmz V284 = IRAS 06131+0055.
V1631	Ori =	760394	= Tmz V263 = IRAS 06144–0205 = GSC 4788.02997.
V1632	Ori =	760398	= Tmz V283 = IRAS 06162+0052 = GSC 0132.02191.
V1633	Ori =	760399	= Be V13 = GSC 0140.01831.
V1634	Ori =	760402	= Be V5 = IRAS 06179+0617 = GSC 0144.01300.
V1635	Ori =	760405	= Be V36 = GSC 0736.01615.
V394	Pav =	761083	= V4/NGC 6752. Probable field star. Labeled V14 in the chart in [201].
V395	Pav =	761084	= V5/NGC 6752. Field star.
V396	Pav =	761085	= V6/NGC 6752. Probable field star. The chart in [201] is wrong.
V397	Pav =	761090	= V8/NGC 6752. Probable field star.
V398	Pav =	761097	= V11/NGC 6752. Probable field star. Labeled V6 in the chart in [201].
V371	Peg =	761214	= Tmz V630 = IRAS 21345+1327 = GSC 1132.00622.
V372	Peg =	761255	= BS 8330 = BD+16°4598 = HD 207223 (F0) = HIP 107558 = SAO 107395 = PPM 140637 = IRAS 21447+1657 = GSC 1670.00650.
V373	Peg =	761260	= NSV 13891 = 13 Peg = BS 8344 = BD+16°4612 = HD 207652 (F2) = HIP 107788 = SAO 107425 = PPM 140701 = IDS 2145.4N1650 = GSC 1670.00919. Variability can be due to the close companion.
V374	Peg =	761307	= HIP 108706 = G 188-38 = IRXS J220111+281849 = GSC 2215.01629.
V375	Peg =	761308	= Be V29 = GSC 1139.00011.
V376	Peg =	761312	= BD+18°4917 = HD 209458 (F8) = HIP 108859 = SAO 107623 = PPM 141002 = GSC 1688.01821.
V377	Peg =	761317	= BD+16°4660 = HD 209775 (F0) = HIP 109055 = SAO 107656 = PPM 141053 = GSC 1684.01373.

Table 2 (continued)

V378 Peg = 761396 = PG 2337+300 = GSC 2766.01346.
V379 Peg = 761402 = NSV 26158 = SVS 2550 = FBS 2351+228 = Peg 7 [005] = GSC 2252.02098.
V611 Per = 760034 = BD+56°501 = SAO 023162 = PPM 027400 = Oo 692 (NGC 869) = GSC 3694.02537.
V612 Per = 760035 = Oo 893 (NGC 869) = GSC 3694.01341E.
V613 Per = 760036 = BD+56°515 = PPM 027417 = Oo 922 (NGC 869) = GSC 3694.01921.
V614 Per = 760037 = BD+56°520 = PPM 027422 = Oo 992 (NGC 869) = GSC 3694.01603E.
V615 Per = 760038 = NSV 00779 = CSV 206 = AN 204.1937 = Oo 1021 (NGC 869) = GSC 3694.01587.
V616 Per = 760039 = W 49 (NGC 869).
V617 Per = 760040 = Oo 1080 (NGC 869) = GSC 3694.02883.
V618 Per = 760041 = Oo 1147 (NGC 869).
V619 Per = 760042 = BD+56°572 = SAO 023246 = PPM 027516 = Oo 2246 (NGC 884) = GSC 3694.01643.
V620 Per = 760043 = Oo 2301 (NGC 884).
V621 Per = 760044 = BD+56°576 = SAO 023252 = PPM 027522 = Oo 2311 (NGC 884) = GSC 3694.01387.
V622 Per = 760045 = BD+56°578 = PPM 027525 = Oo 2371 (NGC 884) = GSC 3694.02229.
V623 Per = 760047 = UVa 144 (NGC 1039) = GSC 2853.00542.
V624 Per = 760048 = UVa 224 (NGC 1039) = GSC 2853.01026.
V625 Per = 760050 = AP 98 (alpha Per) = GSC 3315.01898.
V626 Per = 760051 = AP 101 (alpha Per) = GSC 3319.01425.
V627 Per = 760052 = AP 156 (alpha Per) = GSC 3316.01633.
V628 Per = 760053 = AP 41 (alpha Per) = GSC 3316.01330.
V629 Per = 760054 = AP 114 (alpha Per) = GSC 3316.02173.
V630 Per = 760055 = AP 72 (alpha Per) = GSC 3320.01557.
V631 Per = 760056 = AP 169 (alpha Per) = GSC 3316.00669.
V632 Per = 760062 = Tmz V216 = IRAS 03370+4035 = GSC 2867.01458.
V633 Per = 760064 = Tmz V222 = IRAS 03390+3158 = GSC 2359.01109.
V634 Per = 760068 = Tmz V217 = IRAS 03420+4044 = GSC 2867.01156.
V635 Per = 760070 = Tmz V218 = IRAS 03427+3812 = GSC 2863.02083.
V636 Per = 760073 = Tmz V211 = IRAS 03453+4246 = GSC 2871.01123.
V637 Per = 760077 = NSV 15831 = Tmz V212 = IRC+40072 = IRAS 03507+3623 = GSC 2369.00278.
V638 Per = 760078 = Tmz V215 = IRAS 03539+3954.
V639 Per = 760081 = Tmz V192 = CCS-II 606 = GSC 3335.00648.
V640 Per = 760082 = Tmz V196 = GSC 3339.01090.
V641 Per = 760083 = Tmz V205 = IRAS 04009+4628 = GSC 3327.01361.
V642 Per = 760084 = Tmz V206 = IRAS 04026+4737 = GSC 3331.00914.
V643 Per = 760088 = NSV 01475 = CSV 100369 = Zinner 0271 = HD 26080 (Ma) = BD+36°829 = HIP 019391 = SAO 057018 = PPM 069151 = IRC+40076 = IRAS 04059+3617 = GSC 2370.01075.
V644 Per = 760091 = Tmz V204 = IRAS 04107+4347 = CCS 189 = CCS-II 633 = GSC 2890.00166.
V645 Per = 760092 = Tmz V203 = IRAS 04112+4338 = CCS 190 = CCS-II 636 = GSC 2890.00966.
V646 Per = 760094 = Tmz V213 = IRAS 04123+3504 = GSC 2379.01135.
V647 Per = 760095 = Tmz V208 = IRAS 04126+4132 = GSC 2886.01204.
V648 Per = 760096 = Tmz V214 = IRAS 04142+3510 = GSC 2310.00515.
V649 Per = 760097 = NSV 01542 = S 10639 [034] = Tmz V207 = IRAS 04145+4509 = GSC 3328.00065.
V650 Per = 760098 = Tmz V209 = IRAS 04147+4446 = GSC 2890.02465.
V651 Per = 760099 = Tmz V219 = IRAS 04169+3310 = GSC 2375.00215.
V652 Per = 760100 = W23 = RX J0420.4+3123 = GSC 2371.00740.
V653 Per = 760101 = Tmz V202 = IRAS 04179+4145 = CCS-II 667.
V654 Per = 760103 = Tmz V190 = IRAS 04195+4905 = GSC 3337.00444.
V655 Per = 760105 = Tmz V210 = IRAS 04208+4756 = GSC 3333.01184.
V656 Per = 760109 = Tmz V185 = IRAS 04237+5114 = GSC 3341.00637.
V657 Per = 760115 = Tmz V068 = IRAS 04344+3231 = IRC+30091 = GSC 2377.01182.
CM Phe = 760009 = NSV 00137 = BPM 16078 = L 218-028 = Phe 1 [004].

Table 2 (continued)

CN	Phe =	760015	= NSV 15169 = HD 4494 (A5) = CoD–42°253 = CPD–42°71 = SAO 215235 = PPM 305236 = GSC 7535.00953.
CO	Phe =	760019	= EC 00497–4723 = JL 216 [010].
AF	Pic =	760148	= EC 05321–5605.
DU	Psc =	760001	= IRAS 23590–0402 = GSC 4666.00209.
DV	Psc =	760006	= 1RXS J001309+053550 = LTT 10072 = LP 524-106 = L 1082-041 = GSC 0008.00324.
DW	Psc =	760025	= GSC 0614.01209.
V445	Pup =	760523	= Nova Pup 2000.
V446	Pup =	760461	= Tmz V100 = IRAS 07115–3455 = GSC 7111.01313.
V447	Pup =	760499	= Tmz V339 = IRAS 07278–2721 = GSC 6546.02505.
V448	Pup =	760500	= Tmz V374 = IRAS 07281–2909 = GSC 6550.02846.
V449	Pup =	760503	= Tmz V354 = IRAS 07294–2240.
V450	Pup =	760504	= Tmz V363 = IRAS 07297–3021 = GSC 7105.01715.
V451	Pup =	760506	= Tmz V338 = IRAS 07300–2631 = GSC 6546.02114.
V452	Pup =	760507	= Tmz V372 = IRAS 07303–2858.
V453	Pup =	760508	= Tmz V351 = IRAS 07303–2351.
V454	Pup =	760510	= Tmz V315 = IRAS 07321–1556 = CCS-II 1778.
V455	Pup =	760511	= Tmz V350 = IRAS 07328–2243 = CCS 812 = CCS-II 1782.
V456	Pup =	760513	= Tmz V310 = IRAS 07337–1813 = GSC 5983.01889.
V457	Pup =	760514	= Tmz V320 = IRC–20135 = RAFGL 4614S = IRAS 07338–1946 = GSC 5987.00292.
V458	Pup =	760515	= Tmz V325 = IRAS 07344–2100 = GSC 5992.03214.
V459	Pup =	760516	= Tmz V311 = IRAS 07349–1759 = GSC 5984.01690.
V460	Pup =	760517	= V3 (Melotte 71) = GSC 5405.04186.
V461	Pup =	760518	= Tmz V308 = IRAS 07351–1253.
V462	Pup =	760519	= V5 (Melotte 71).
V463	Pup =	760520	= V2 (Melotte 71) = GSC 5405.01792.
V464	Pup =	760521	= V4 (Melotte 71) = GSC 5405.01727.
V465	Pup =	760522	= V1 (Melotte 71) = GSC 5405.02017.
V466	Pup =	760524	= Tmz V348 = IRAS 07366–2200.
V467	Pup =	760526	= Tmz V349 = IRAS 07375–2215 = GSC 5992.03745.
V468	Pup =	760528	= NSV 17550 = BS 2968 = CoD–37°3770 = CPD–37°1444 = HD 61925 (B3) = HIP 037345 = SAO 198273 = PPM 284247 = GSC 7644.02701.
V469	Pup =	760530	= Tmz V353 = IRAS 07378–2236 = CCS 850 = CCS-II 1826 = GSC 6539.01929.
V470	Pup =	760531	= Tmz V347 = IRAS 07385–2203.
V471	Pup =	760532	= Tmz V346 = IRAS 07390–2618 = CCS 859 = CCS-II 1834.
V472	Pup =	760534	= Tmz V319 = IRAS 07401–1801 = CCS 868 = CCS-II 1845.
V473	Pup =	760535	= Tmz V321 = IRAS 07402–1747 = GSC 5984.01460.
V474	Pup =	760537	= Tmz V323 = IRAS 07410–1623 = GSC 5980.00272.
V475	Pup =	760538	= Tmz V371 = IRAS 07416–3146.
V476	Pup =	760539	= Tmz V355 = IRAS 07421–2457.
V477	Pup =	760540	= Tmz V324 = IRAS 07427–1453 = GSC 5981.00545.
V478	Pup =	760541	= Tmz V303 = IRAS 07431–1241 = GSC 5418.01742.
V479	Pup =	760544	= NSV 17600 = Tmz V095 = IRAS 07448–2711 = CCS 896 = CCS-II 1875.
V480	Pup =	760545	= NSV 17608 = Tmz V362 = IRAS 07458–2946 = CCS-II 1884.
V481	Pup =	760547	= Tmz V366 = IRAS 07470–3459 = Wray 18-28 = CSS 265 = CSS-II 410 = GSC 7127.00778.
V482	Pup =	760548	= Tmz V352 = IRAS 07470–2258 = GSC 6553.00646.
V483	Pup =	760549	= Tmz V313 = IRAS 07482–1758.
V484	Pup =	760550	= Tmz V314 = IRAS 07489–1749.
V485	Pup =	760551	= Tmz V360 = IRAS 07497–3506 = RAFGL 4642S = GSC 7127.00431.
V486	Pup =	760552	= Tmz V369 = IRAS 07500–2957 = GSC 7119.00831.
V487	Pup =	760554	= Tmz V343 = IRAS 07501–2420 = CCS 928 = CCS-II 1917 = GSC 6557.00450.
V488	Pup =	760555	= Tmz V370 = IRAS 07506–2959 = GSC 7119.01362.
V489	Pup =	760558	= Tmz V468 = IRAS 07515–2854 = GSC 6565.03202.
V490	Pup =	760559	= Tmz V368 = IRAS 07519–3016 = GSC 7119.01812.
V491	Pup =	760560	= Tmz V467 = IRAS 07519–2904 = GSC 6565.01927.

Table 2 (continued)

V492 Pup = 760561 = Tmz V322 = IRAS 07517–1609 = GSC 5982.01287.
V493 Pup = 760562 = CoD–33°4290 = Tmz V361 = IRAS 07525–3400 = CCS 949 = CCS-II 1943 = GSC 7127.01440.
V494 Pup = 760563 = Tmz V440 = IRAS 07525–3213 = Wray 18-34 = CCS 947 = CCS-II 1941 = GSC 7123.01429 = GSC 7123.02239.
V495 Pup = 760564 = Tmz V312 = IRAS 07528–1901 = GSC 5990.01259.
V496 Pup = 760565 = CoD–32°4567 = Tmz V439 = GSC 7123.01239.
V497 Pup = 760566 = NSV 17658 = Tmz V466 = IRAS 07532–2920 = CCS 956 = CCS-II 1951 = GSC 6565.03056.
V498 Pup = 760567 = Tmz V404 = IRAS 07535–1235.
V499 Pup = 760568 = Tmz V424 = IRAS 07543–2333.
V500 Pup = 760569 = Tmz V480 = IRAS 07546–2807 = GSC 6565.02856.
V501 Pup = 760573 = Tmz V465 = IRAS 07553–2849 = GSC 6566.01924.
V502 Pup = 760575 = Tmz V376 = IRAS 07559–3125 = GSC 7120.01854.
V503 Pup = 760576 = Tmz V463 = IRAS 07561–3047 = GSC 7120.02055.
V504 Pup = 760578 = Tmz V462 = IRAS 07572–3111 = CCS 979 = CCS-II 1982 = GSC 7120.00730.
V505 Pup = 760580 = Tmz V402 = IRAS 07581–1357.
V506 Pup = 760581 = Tmz V412 = IRAS 07584–1537 = GSC 5995.02159.
V507 Pup = 760582 = Tmz V430 = IRAS 07588–2418 = CCS 992 = CCS-II 1999.
V508 Pup = 760583 = Tmz V437 = IRAS 07596–3145 = GSC 7124.03657.
V509 Pup = 760585 = Tmz V464 = IRAS 08004–3023 = CCS 1002 = CCS-II 2010 = GSC 7120.01465.
V510 Pup = 760586 = Tmz V429 = IRAS 08005–2356 = GSC 6554.00559.
V511 Pup = 760587 = Tmz V403 = IRAS 08008–1205 = IRC–10186 = RAFGL 4661S = GSC 5421.01424.
V512 Pup = 760588 = Tmz V436 = IRAS 08013–3129 = GSC 7120.02020.
V513 Pup = 760589 = Tmz V435 = IRAS 08013–3121 = Wray 18-40 = CCS 1014 = CCS-II 2025 = GSC 7120.00932.
V514 Pup = 760590 = Tmz V415 = IRAS 08012–1752 = GSC 5999.01041.
V515 Pup = 760591 = Tmz V434 = IRAS 08017–3118 = IRC–30114 = AFGL 1223 = GSC 7120.00860.
V516 Pup = 760592 = RX J0803.4–4748 = 1RXS J080346.3–474838.
V517 Pup = 760595 = Tmz V433 = IRAS 08026–3122 = GSC 7120.00184.
V518 Pup = 760600 = Tmz V416 = IRAS 08045–1524 = CCS-II 2056.
V519 Pup = 760601 = Tmz V454 = IRAS 08051–3230 = GSC 7125.01324.
V520 Pup = 760602 = Tmz V455 = GSC 7125.01721.
V521 Pup = 760603 = NSV 17741 = Tmz V469 = IRAS 08050–2939 = Wray 18-47 = CCS 1045 = CCS-II 2063 = GSC 6567.02389.
V522 Pup = 760604 = Tmz V456 = IRAS 08055–3214 = CCS 1052 = CCS-II 2071 = GSC 7125.01210.
V523 Pup = 760605 = Tmz V428 = GSC 6563.01709.
V524 Pup = 760606 = Tmz V427 = IRAS 08057–2623 = GSC 6563.01655.
V525 Pup = 760608 = Tmz V422 = IRAS 08058–2234 = GSC 6555.01564.
V526 Pup = 760609 = Tmz V453 = IRAS 08061–3248 = GSC 7125.02966.
V527 Pup = 760612 = CoD–25°5631 = Tmz V423 = IRAS 08065–2534 = CSS-II 468 = GSC 6559.01738.
V528 Pup = 760613 = CoD–28°5528 = Tmz V432 = IRAS 08070–2820 = GSC 6567.01158.
V529 Pup = 760614 = Tmz V458 = IRAS 08071–3216 = GSC 7125.04357.
V530 Pup = 760615 = Tmz V459 = IRAS 08073–3239 = GSC 7125.04387.
V531 Pup = 760617 = NSV 17764 = CoD–29°5653 = Tmz V470 = IRAS 08081–2923 = Wray 18-52 = CCS 1071 = CCS-II 2090 = GSC 6567.02204.
V532 Pup = 760618 = Tmz V460 = IRAS 08085–3238.
V533 Pup = 760620 = Tmz V426 = IRAS 08091–2744 = GSC 6563.03089.
V534 Pup = 760621 = Tmz V411 = IRAS 08098–2012 = GSC 6004.01288.
V535 Pup = 760622 = Tmz V414 = IRAS 08098–1953 = CCS 1085 = CCS-II 2105 = GSC 6004.00540.
V536 Pup = 760623 = Tmz V461 = IRAS 08102–3105 = Wray 18-54 = CSS 297 = CSS-II 476 = GSC 7121.02277.
V537 Pup = 760624 = Tmz V471 = IRAS 08104–3000 = GSC 7121.01084.
V538 Pup = 760625 = Tmz V410 = IRAS 08109–1947 = GSC 6004.02152.

Table 2 (continued)

V539 Pup = 760626 = Tmz V425 = IRAS 08115–2548.
V540 Pup = 760628 = Tmz V451 = IRAS 08126–3049 = GSC 7121.02053.
V541 Pup = 760632 = Tmz V476 = IRAS 08138–3414 = GSC 7130.00158.
V542 Pup = 760633 = Tmz V449 = IRAS 08139–3116 = GSC 7122.03936.
V543 Pup = 760634 = Tmz V450 = IRAS 08141–3103 = CCS 1112 = CCS-II 2135 = GSC 7122.03830.
V544 Pup = 760635 = Tmz V472 = IRAS 08142–3225 = GSC 7126.00217.
V545 Pup = 760636 = Tmz V452 = IRAS 08149–3003 = GSC 7122.00892.
V546 Pup = 760637 = CoD–33°4783 = Tmz V477 = IRAS 08152–3407 = GSC 7130.00837.
V547 Pup = 760638 = Had V38 = IRAS 08159–2812 = Wray 18-59 = CCS 1117 = CCS-II 2142 = GSC 6568.03025.
V548 Pup = 760639 = Tmz V475 = IRAS 08167–3141 = GSC 7122.00290.
V549 Pup = 760640 = Tmz V478 = IRAS 08170–3441 = CCS 1125 = CCS-II 2152 = GSC 7130.02344.
V550 Pup = 760641 = Tmz V474 = IRAS 08175–3154 = GSC 7126.00927.
V551 Pup = 760642 = Tmz V473 = IRAS 08183–3204 = GSC 7126.03659.
V552 Pup = 760643 = BD–18°2290 = HD 70379 (G5) = IRAS 08187–1905 = GSC 6005.01804.
V553 Pup = 760645 = Tmz V398 = IRAS 08194–1332.
V554 Pup = 760648 = Tmz V417 = IRAS 08197–1732.
V555 Pup = 760649 = Tmz V409 = GSC 6001.01232. The discoverer's identification of GSC 6001.01232 with IRAS 08199–1751 is doubtful, the GSC star appears not red.
V556 Pup = 760650 = Tmz V408 = IRAS 08203–1753 = GSC 6001.01584.
V557 Pup = 760651 = Tmz V413 = IRAS 08205–1508 = CCS-II 2178.
V558 Pup = 760652 = Tmz V432 = IRAS 08211–3302.
V559 Pup = 760653 = Tmz V407 = IRAS 08213–2122 = GSC 6009.05413.
V560 Pup = 760655 = CoD–26°5976 = Tmz V419 = IRAS 08219–2635 = GSC 6577.02205.
V561 Pup = 760657 = Tmz V421 = IRAS 08222–2411.
V562 Pup = 760658 = Tmz V441 = IRAS 08228–3335 = CCS 1166 = CCS-II 2199 = GSC 7143.00661.
V563 Pup = 760659 = Tmz V443 = IRAS 08228–3257 = GSC 7139.01369.
V564 Pup = 760660 = CoD–24°6912 = Tmz V420 = IRAS 08228–2512 = CCS 1164 = CCS-II 2197 = GSC 6573.03781.
V565 Pup = 760661 = Had V33 = IRAS 08229–2231.
V566 Pup = 760662 = Tmz V442 = IRAS 08237–3308 = GSC 7139.02309.
V567 Pup = 760664 = Tmz V405 = IRAS 08245–1318 = GSC 5440.01744.
V568 Pup = 760666 = Tmz V397 = IRAS 08251–1233 = GSC 5436.02343.
AS Pyx = 760665 = Tmz V418 = GSC 6573.05124.
AT Pyx = 760668 = Tmz V444 = PHalpha 92 [260] = HBC 562 = IRAS 08267–3336 = Wray 15-220. In the region of the cometary globule CG 22.
AU Pyx = 760669 = Tmz V448 = IRAS 08274–3323 = CCS 1190 = CCS-II 2225 = GSC 7139.02409.
AV Pyx = 760670 = Had V34 = IRAS 08288–2137 = CCS-II 2229.
AW Pyx = 760671 = CoD–26°6153 = Tmz V431 = IRAS 08297–2626 = GSC 6578.04100.
AX Pyx = 760672 = Tmz V445 = IRAS 08299–3403 = GSC 7143.01096.
AY Pyx = 760673 = Tmz V446 = IRAS 08301–3401 = CCS 1202 = CCS-II 2238 = GSC 7143.00570.
AZ Pyx = 760674 = Tmz V447 = IRAS 08308–3404 = GSC 7143.00011.
BB Pyx = 760676 = Tmz V508 = IRAS 08323–2135 = GSC 6023.01261.
BC Pyx = 760678 = Tmz V506 = IRAS 08333–2705 = GSC 6578.02443.
BD Pyx = 760680 = Tmz V037 = IRAS 08338–1904.
BE Pyx = 760683 = Tmz V505 = IRAS 08355–2154 = GSC 6023.02379.
BF Pyx = 760684 = Tmz V500 = IRAS 08360–1804 = GSC 6015.01383.
BG Pyx = 760685 = Tmz V499 = IRAS 08362–1730 = GSC 6015.00575.
BH Pyx = 760687 = NSV 04223 = CSV 1356 = HV 8154 = AN 405.1933 = Prager 570 = IRAS 08416–3220 = Wray 18-100 = CSS 328 = CSS-II 543 = He-3 196.
BI Pyx = 760691 = CoD–22°6653 = Tmz V504 = IRAS 08480–2307 = GSC 6572.00687.
BK Pyx = 760693 = Tmz V493 = IRAS 08490–1925 = GSC 6021.01280.
BL Pyx = 760696 = BD–22°2460 = CoD–22°6809= CPD–22°4017 = Tmz V503 = IRAS 08568–2304 = IRC–20181 = GSC 6585.00123.
BM Pyx = 760701 = Tmz V509 = IRAS 08591–2354 = GSC 6585.01266.

Table 2 (continued)

BN	Pyx =	760703	= Tmz V510 = IRAS 09001–2335 = GSC 6585.01280.
BO	Pyx =	760704	= Tmz V481 = IRAS 09005–1945 = GSC 6022.01419.
BP	Pyx =	760705	= CoD–23°8023 = Tmz V511 = IRAS 09016–2337 = GSC 6585.01488.
BQ	Pyx =	760706	= Tmz V091 = GSC 6598.00592.
BR	Pyx =	760707	= Tmz V090 = IRAS 09021–2917 = GSC 6598.02345.
BS	Pyx =	760708	= Tmz V483 = IRAS 09024–1955 = CCS-II 2416 = GSC 6035.02026.
BT	Pyx =	760709	= Tmz V502 = IRAS 09028–2802 = GSC 6598.00224.
BU	Pyx =	760710	= Tmz V482 = IRAS 09028–1945 = GSC 6035.01586.
BV	Pyx =	760711	= Tmz V484 = IRAS 09042–2049 = GSC 6039.01084.
BW	Pyx =	760714	= CoD–24°7720 = CPD–24°3973 = SAO 176975 = PPM 255671 = Tmz V520 = IRAS 09046–2427 = GSC 6590.00111.
BX	Pyx =	760715	= Tmz V527 = IRAS 09049–2704 = GSC 6594.02376.
BY	Pyx =	760716	= CoD–27°6270 = CPD–27°3632 = SAO 176990 = PPM 255682 = Tmz V526 = IRAS 09054–2719 = GSC 6594.00840.
BZ	Pyx =	760717	= CoD–27°6284 = CPD–27°3642 = Tmz V501 = IRAS 09060–2807 = GSC 6598.00208.
CC	Pyx =	760718	= Tmz V518 = IRAS 09071–2200.
CD	Pyx =	760719	= Tmz V519 = IRAS 09074–2425 = GSC 6590.00594.
CE	Pyx =	760721	= CoD–26°6785 = Tmz V525 = IRAS 09075–2703 = GSC 6594.02479.
CF	Pyx =	760726	= CoD–24°7867 = Tmz V529 = IRAS 09122–2419 = CCS 1409 = CCS-II 2454 = GSC 6591.00315.
CG	Pyx =	760727	= Tmz V516 = IRAS 09126–2628 = GSC 6595.01458.
CH	Pyx =	760729	= CoD–24°7882 = Tmz V528 = IRAS 09131–2431 = GSC 6591.00703.
CI	Pyx =	760732	= Tmz V523 = IRAS 09149–2823 = GSC 6599.00349.
CK	Pyx =	760735	= Tmz V524 = IRAS 09157–2852 = GSC 6599.02259.
CL	Pyx =	760736	= Tmz V522 = IRAS 09201–2814 = GSC 6600.01711.
CM	Pyx =	760737	= CoD–28°7198 = Tmz V521 = IRAS 09210–2832 = GSC 6600.00355.
V349	Sge =	761036	= Mis V0300 = IRAS 18552+1944 = GSC 1593.01782.
V350	Sge =	761059	= Mis V0327.
V351	Sge =	761062	= Mis V0328.
V352	Sge =	761069	= Mis V0518 = IRAS 18594+1858.
V353	Sge =	761108	= 19286+1733 = 84-01800.
V354	Sge =	761111	= 19313+1901 = 76-13269.
V355	Sge =	761113	= Antipin Var 69 = GSC 1609.01624.
V4642	Sgr =	760913	= Nova Sgr 2000.
V4643	Sgr =	760910	= Nova Sgr 2001.
V4644	Sgr =	760890	= D018 (Quintuplet cluster).
V4645	Sgr =	760891	= D200 (Quintuplet cluster).
V4646	Sgr =	760892	= Q5 (Quintuplet cluster).
V4647	Sgr =	760893	= D004 (Quintuplet cluster) [162] = 134 [267] = "Pistol star".
V4648	Sgr =	760894	= D230 (Quintuplet cluster).
V4649	Sgr =	760895	= D020 (Quintuplet cluster).
V4650	Sgr =	760896	= D006 (Quintuplet cluster) [162] = 362 [267].
V4651	Sgr =	760903	= Mis V0073.
V4652	Sgr =	760905	= Mis V0001.
V4653	Sgr =	760906	= Mis V0786 = IRAS 17501–1734.
V4654	Sgr =	760907	= Mis V0004.
V4655	Sgr =	760909	= Mis V0912 = IRAS 17515–1943.
V4656	Sgr =	760917	= Mis V0855.
V4657	Sgr =	760920	= Mis V0627.
V4658	Sgr =	760923	= Mis V0638.
V4659	Sgr =	760924	= Mis V0833 = IRAS 17545–2559.
V4660	Sgr =	760926	= Mis V0532.
V4661	Sgr =	760927	= Mis V0629.
V4662	Sgr =	760928	= Mis V0834 = IRAS 17547–2206.
V4663	Sgr =	760930	= Mis V0835 = IRAS 17547–2446.
V4664	Sgr =	760931	= Mis V0790.
V4665	Sgr =	760933	= Mis V0859.
V4666	Sgr =	760934	= Mis V0474.
V4667	Sgr =	760938	= Mis V0861.

Table 2 (continued)

V4668 Sgr = 760939 = Mis V0837 = IRAS 17553–2751.
V4669 Sgr = 760940 = Mis V0085.
V4670 Sgr = 760942 = Mis V0481 = IRAS 17555–2812.
V4671 Sgr = 760943 = Mis V0405 = IRAS 17557–1814.
V4672 Sgr = 760944 = Mis V0087.
V4673 Sgr = 760945 = Mis V0839 = IRAS 17558–2033.
V4674 Sgr = 760948 = Mis V0473 = GSC 6853.02916.
V4675 Sgr = 760949 = Mis V0636.
V4676 Sgr = 760950 = Mis V0539.
V4677 Sgr = 760951 = Mis V0794.
V4678 Sgr = 760953 = Mis V0484 = IRAS 17561–2950.
V4679 Sgr = 760954 = Mis V0485 = IRAS 17562–2052.
V4680 Sgr = 760955 = Mis V0407 = IRAS 17564–1648.
V4681 Sgr = 760957 = Mis V0725.
V4682 Sgr = 760958 = Mis V0088.
V4683 Sgr = 760960 = NSV 24062.
V4684 Sgr = 760961 = Mis V0086.
V4685 Sgr = 760962 = Mis V0864.
V4686 Sgr = 760963 = Mis V0084.
V4687 Sgr = 760964 = Mis V0867.
V4688 Sgr = 760965 = Mis V0868.
V4689 Sgr = 760966 = Mis V0869.
V4690 Sgr = 760967 = Mis V0047.
V4691 Sgr = 760968 = Mis V0093 = IRAS 17568–2950.
V4692 Sgr = 760969 = Mis V0489 = IRAS 17570–2747.
V4693 Sgr = 760970 = Mis V0046.
V4694 Sgr = 760972 = Mis V0796.
V4695 Sgr = 760973 = Mis V0846 = IRAS 17574–2937.
V4696 Sgr = 760974 = Mis V0050.
V4697 Sgr = 760975 = Mis V0543.
V4698 Sgr = 760977 = Mis V0899.
V4699 Sgr = 760979 = Mis V0495 = IRAS 17579–2340.
V4700 Sgr = 760980 = Mis V0070.
V4701 Sgr = 760981 = Mis V0637.
V4702 Sgr = 760982 = Mis V0890.
V4703 Sgr = 760983 = Mis V0414.
V4704 Sgr = 760984 = Mis V0630.
V4705 Sgr = 760986 = Mis V0873.
V4706 Sgr = 760987 = Mis V0874 = GSC 6850.02516.
V4707 Sgr = 760988 = Mis V0044.
V4708 Sgr = 760989 = Mis V0875.
V4709 Sgr = 760990 = Mis V0418 = IRAS 17590–1706.
V4710 Sgr = 760992 = Mis V0552.
V4711 Sgr = 760993 = Mis V0800.
V4712 Sgr = 760994 = Mis V0851 = IRAS 17592–2750.
V4713 Sgr = 760995 = Mis V0876.
V4714 Sgr = 760996 = Mis V0498 = IRAS 17594–2451.
V4715 Sgr = 760997 = Mis V0065.
V4716 Sgr = 761000 = Mis V0499 = IRAS 17598–2117.
V4717 Sgr = 761001 = Mis V0906.
V4718 Sgr = 761002 = Mis V0503 = IRAS 18000–2739.
V4719 Sgr = 761003 = Mis V0091.
V4720 Sgr = 761006 = Mis V0805.
V4721 Sgr = 761007 = Mis V0806.
V4722 Sgr = 761009 = RX J1810.7–2609 = SAX J1810.8–2609.
V4723 Sgr = 761010 = Had V49.
V4724 Sgr = 761011 = Had V41 = IRAS 18090–1853 = IRC–20444 = AFGL 2087.
V4725 Sgr = 761012 = Had V58 = IRAS 18102–2857 = GSC 6855.01348.
V4726 Sgr = 761017 = Had V50 = GSC 6869.00656.

Table 2 (continued)

V4727	Sgr =	761023	= CoD–29°15079 = Had V48 = GSC 6870.00614.
V4728	Sgr =	761030	= HD 172481 (G0) = CoD–28°14878 = CPD–28°6640 = SAO 187137 = PPM 268756 = IRAS 18384–2800 = GSC 6866.00928.
V4729	Sgr =	761038	= Mis V0371.
V4730	Sgr =	761051	= Mis V0445 = GSC 6282.00758.
V4731	Sgr =	761054	= Mis V0391 = IRAS 18565–1355.
V4732	Sgr =	761055	= LS IV–14°109 = GSC 5718.00587.
V4733	Sgr =	761075	= Mis V0472 = IRAS 18594–1829 = GSC 6286.00089.
V4734	Sgr =	761086	= Had V57 = GSC 6882.01768.
V4735	Sgr =	761098	= Had V17 = IRAS 19107–1829.
V4736	Sgr =	761117	= Had V51.
V4737	Sgr =	761164	= Had V21 = GSC 7442.00876.
V4738	Sgr =	761166	= RX J2022.6–3954.
V1143	Sco =	760828	= Tmz V334 = IRAS 15481–2134 = GSC 6198.01054.
V1144	Sco =	760830	= NSV 20443 = NTTS 155331–2340 = Sco PMS 013 = GSC 6779.00602.
V1145	Sco =	760833	= NSV 20446 = NTTS 155357–2321 = Sco PMS 014.
V1146	Sco =	760834	= NSV 20450 = NTTS 155421–2330 = Sco PMS 015 = GSC 6779.00982.
V1147	Sco =	760835	= NSV 20451 = NTTS 155427–2346 = Sco PMS 016 = GSC 6779.01217.
V1148	Sco =	760836	= NSV 20452 = NTTS 155436–2313 = Sco PMS 017 = GSC 6779.01757.
V1149	Sco =	760837	= BD–22°4059 = CoD–22°11272= CPD–22°6099 = HD 143006 (G5) = SAO 183986 = PPM 264939 = IRAS 15556–2248 = He-3 1126 = HBC 608 = GSC 6779.00305.
V1150	Sco =	760838	= NSV 20467 = NTTS 155703–2212 = Sco PMS 019 = GSC 6199.00218.
V1151	Sco =	760840	= NSV 20474 = NTTS 155808–2219 = Sco PMS 020 = GSC 6212.00010.
V1152	Sco =	760841	= NSV 20476 = CoD–22°11298 = NTTS 155828–2232= Sco PMS 021 = GSC 6779.00174.
V1153	Sco =	760842	= NSV 20478 = NTTS 155910–2247 = Sco PMS 022.
V1154	Sco =	760843	= NSV 20479 = NTTS 155913–2233 = Sco PMS 023 = GSC 6779.02091.
V1155	Sco =	760844	= Had V40 = IRAS 16008–2640.
V1156	Sco =	760845	= NSV 20496 = NTTS 160153–1922 = Sco PMS 027 = GSC 6208.01239.
V1157	Sco =	760847	= NSV 20535 = NTTS 160827–1813 = Sco PMS 045 = GSC 6205.01178.
V1158	Sco =	760848	= Tmz V333.
V1159	Sco =	760849	= HRC 255 = GSC 6793.00653. May be identical to Do-Ar 9 [139]. This is not NSV 07613 but its comparison star "d" [268].
V1160	Sco =	760850	= Tmz V337 = IRAS 16176–3146.
V1161	Sco =	760855	= Had V31 = IRAS 16293–3939.
V1162	Sco =	760857	= Had V22 = IRAS 16426–3627.
V1163	Sco =	760886	= NSV 22559 = Tmz V736 = He-3 1423 = Wray 18-313 = IRAS 17302–3613 = CCS 2455 = CCS-II 3844.
V1164	Sco =	760888	= V29/NGC 6388. Foreground star.
V1165	Sco =	760897	= V36/NGC 6441. Cluster non-member.
V1166	Sco =	760898	= SV1/NGC 6441. Cluster non-member.
V1167	Sco =	760899	= V50/NGC 6441. Probable cluster foreground star.
V1168	Sco =	760900	= V47/NGC 6441. Probable cluster foreground star.
V1169	Sco =	760901	= V49/NGC 6441. Probable cluster foreground star.
V1170	Sco =	760902	= V48/NGC 6441. Probable cluster foreground star.
V1171	Sco =	760908	= Mis V0071.
V1172	Sco =	760911	= Mis V0060.
V1173	Sco =	760912	= Mis V0067.
V1174	Sco =	760914	= Mis V0064.
V1175	Sco =	760915	= Mis V0076 = IRAS 17523–3046.
V1176	Sco =	760916	= Mis V0530.
V1177	Sco =	760921	= Mis V0061.
delta	Sco =	76083	= δ Sco = 7 Sco = BS 5953 = BD–22°4068 = CoD–22°11292 = CPD–22°6106 = HD 143275 (B0) = HIP 078401 = SAO 184014 = PPM 264979 = IRAS 15573–2228 = IRC–20303 = GSC 6779.02194.
BX	Scl =	761398	= CS 22966-043 = GSC 6987.00658.
BY	Scl =	761400	= CS 29499-057 = GSC 6985.00342.
V463	Sct =	761024	= Had V46 = Nova Sct 2000.
V464	Sct =	761016	= Had V32 = IRAS 18223–0652 = IRC–10418 = RAFGL 5233S = GSC 5111.00308.

Table 2 (continued)

V465 Sct = 761028 = Had V47 = GSC 6280.00220.
V466 Sct = 761045 = Mis V0248 = IRAS 18559–0408.
V467 Sct = 761052 = Mis V0437 = IRAS 18562–1519.
V344 Ser = 760816 = Tmz V044 = GSC 0347.00695.
V345 Ser = 760817 = Tmz V332 = GSC 0923.00693.
V346 Ser = 760818 = Tmz V045 = GSC 0926.00303.
V347 Ser = 760819 = Tmz V047 = GSC 0345.01078.
V348 Ser = 760881 = Had V54 = IRAS 17231–1400.
V349 Ser = 760884 = Had V55 = IRAS 17275–1016.
V350 Ser = 760918 = Mis V0396 = IRAS 17541–1422.
V351 Ser = 760919 = Mis V0824 = IRAS 17545–0028.
V352 Ser = 760922 = Mis V0593 = IRAS 17547–1012.
V353 Ser = 760925 = Mis V0267.
V354 Ser = 760929 = Mis V0399 = IRAS 17550–1053.
V355 Ser = 760932 = Mis V0599 = IRAS 17551–1140.
V356 Ser = 760936 = Mis V0401 = IRAS 17555–1145.
V357 Ser = 760937 = Mis V0402 = IRAS 17555–1336.
V358 Ser = 760941 = Mis V0404 = IRAS 17557–1545.
V359 Ser = 760946 = Mis V0595.
V360 Ser = 760947 = Mis V0379.
V361 Ser = 760952 = Mis V0381.
V362 Ser = 760959 = Mis V0383.
V363 Ser = 760971 = Mis V0616 = IRAS 17574–1430.
V364 Ser = 760976 = Mis V0297 = IRAS 17581–1032.
V365 Ser = 760978 = Mis V0385.
V366 Ser = 760985 = Mis V0386.
V367 Ser = 760991 = Mis V0597 = IRAS 17593–1039.
V368 Ser = 760998 = Mis V0281 = IRAS 18001–0252.
V369 Ser = 760999 = Mis V0422 = IRAS 17599–1541.
V370 Ser = 761019 = EC 37 = IRAS 18272+0114.
V371 Ser = 761020 = EC 53.
UZ Sex = 760748 = PG 1026+002 = WD 1026+002 = GSC 4905.00370.
V1185 Tau = 760060 = IRAS 03359+2932 = GSC 1811.00767.
V1186 Tau = 760065 = CFHT-PL8.
V1187 Tau = 760067 = HD 23194 (A2) = BD+24°540 = SAO 076113 = PPM 092790 = GSC 1803.00486.
V1188 Tau = 760069 = HII 706 (Pleiades) = GSC 1803.00810.
V1189 Tau = 760071 = HII 930 (Pleiades) = GSC 1800.01918.
V1190 Tau = 760072 = Tmz V221 = IRAS 03444+2949 = GSC 1812.00312.
V1191 Tau = 760074 = Tmz V624 = IRAS 03467+0555 = GSC 0071.00544.
V1192 Tau = 760075 = Tmz V220 = IRAS 03474+2731 = GSC 1808.01561.
V1193 Tau = 760076 = HII 2966 (Pleiades) = GSC 1800.01516.
V1194 Tau = 760079 = W2 = HD 285372B (K) = RX J0403.4+1725 = GSC 1254.00309.
V1195 Tau = 760085 = W7 = RX J0406.8+2541 = GSC 1818.00144.
V1196 Tau = 760086 = W9 = RX J0408.2+1956 = GSC 1259.00712.
V1197 Tau = 760087 = W10 = HD 281691 (G5) = RX J0409.2+2901 = GSC 1826.00877.
V1198 Tau = 760090 = W14 = RX J0412.8+2442 = GSC 1819.00498.
V1199 Tau = 760093 = W18 = BD+20°719 = HD 284266 (F8) = RX J0415.4+2044 = GSC 1263.01027.
V1200 Tau = 760104 = W27 = HD 285751 (G5) = RX J0423.7+1537 = GSC 1264.00822.
V1201 Tau = 760106 = W28 = BD+26°718B = HD 283641B = IDS 0418.7N2630B = RX J0424.8+2643B = GSC 1824.00183.
V1202 Tau = 760111 = W32 = HD 284496 (G0) = RX J0431.3+2150 = GSC 1277.01238.
V1203 Tau = 760112 = W36 = HD 285840 (K2) = PPM 120001 = RX J0432.7+1853 = GSC 1274.01501.
V1204 Tau = 760116 = W47 = HD 285957 (K2) = RX J0438.7+1546 = GSC 1266.01195.
V1205 Tau = 760118 = W52 = RX J0444.4+2017 = GSC 1275.00271.
V1206 Tau = 760120 = W55 = BD+15°675 = HD 30171 (G5) = SAO 094104 = PPM 120221 = RX J0445.8+1556 = GSC 1267.00425.
V1207 Tau = 760128 = W75 = RX J0458.7+2046 = GSC 1293.02396.
V1208 Tau = 760129 = Tau 3 [005] = RX J0459.7+1926.

Table 2 (continued)

KO	UMa =	760631	= BD+66°541 = HD 68192 (F2) = HIP 040462 = SAO 014472 = PPM 016542 = GSC 4132.01370.
KP	UMa =	760689	= BD+66°575 = HD 74425 (F8) = HIP 043185 = SAO 014663 = PPM 016775 = GSC 4134.00813.
KQ	UMa =	760733	= Tmz V083 = GSC 4376.01629.
KR	UMa =	760743	= Standard 5 for QSO 0957+561 = GSC 3817.01188.
KS	UMa =	760745	= SBS 1017+533.
KT	UMa =	760779	= NSV 05028 = CSV 6808 = BV 37 [110] = GSC 3827.00104.
KU	UMa =	760781	= Tmz V746 = GSC 3830.00868.
KV	UMa =	760783	= XTE J1118+480.
KW	UMa =	760786	= BD+62°1198 = HD 102355 (F0) = HIP 057498 = SAO 015631 = PPM 018007 = GSC 4153.00579.
KX	UMa =	760788	= Tmz V329 = GSC 4157.00495.
KY	UMa =	760791	= PG 1219+534 = GSC 3834.00078.
V383	Vel =	760746	= NSV 04834 = CSV 1601 = AN 264.1935 = HV 8280 = Prager 3410.
delta	Vel =	760688	= δ Vel = BS 3485 = CoD–54°2351 = CPD–54°1788 = HD 74956 (A0) = HIP 042913 = SAO 236232 = PPM 337198 = IRAS 08433–5431 = IDS 0841.9S5420AB = GSC 8573.03571.
OP	Vir =	760796	= BD+05°2709 = HD 113410 (Ma) = SAO 119743 = PPM 159439 = IRAS 13009+0510 = IRC+10263 = RAFGL 4876S = GSC 0301.00004.
OQ	Vir =	760798	= Tmz V747 = GSC 0306.00750.
OR	Vir =	760800	= Tmz V748 = IRAS 13295–1924 = GSC 6129.00415.
OS	Vir =	760801	= Neighbour of UX Vir.
OT	Vir =	760802	= Tmz V261 = GSC 4975.01098.
OU	Vir =	760805	= LBQ 1432–0033 = Vir 4 [005].
OV	Vir =	760809	= BD–01°2973 = HD 129231 (A2) = HIP 071820 = SAO 140074 = PPM 179358 = GSC 4989.00705.
V406	Vul =	761047	= XTE 1859+226.
V407	Vul =	761099	= RX J1914.4+2456.
V408	Vul =	761110	= Star 4 (NGC 6802).
V409	Vul =	761116	= He-3 1764 = LS II+22°8 = GSC 2138.00723.
V410	Vul =	761119	= 19430+2326 = 52-04808.
V411	Vul =	761120	= 19431+2305 = 53-00371.
V412	Vul =	761121	= 19456+2412 = 03-00092.
V413	Vul =	761122	= 19462+2409 = 03-06544.
V414	Vul =	761123	= 19462+2501 = 08-00258.
V415	Vul =	761125	= 19468+2447 = 07-11383 = GSC 2143.01574.
V416	Vul =	761128	= 19504+2652 = 18-00380.
V417	Vul =	761129	= 19508+2620 = 15-00026.
V418	Vul =	761142	= Mis V0719.
V419	Vul =	761156	= NSV 12861 = IRC+30416 = RAFGL 5473S = CCS 2871 = CCS-II 4711 = IRAS 20082+2911 = GSC 2166.00278.
V420	Vul =	761172	= NSV 25415 = Tmz V02 = TAV J2059+264 = Q 1996/020 = IRAS 20574+2616 = GSC 2180.01553.
V421	Vul =	761175	= BD+23°4222 = HD 200512 (Ma) = SAO 089407 = PPM 112347 = IRC+20500 = IRAS 21009+2415 = GSC 2176.01145.
V422	Vul =	761178	= Had V18 = IRAS 21030+2642.

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TIMES OF MINIMA OF ECLIPSING BINARIES DI HERCULIS AND V1143 CYGNI

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VAR 1

Name of the object:
DI Herculis = HD 175227

Equatorial coordinates:	**Equinox:**
R.A.= $18^h53^m26\overset{s}{.}24$ **DEC.=** $+24°16'40\overset{''}{.}8$	J2000

Comparison star(s):	HD 174932

Check star(s):	HD 343238

VAR 2

Name of the object:
V1143 Cygni = HD 185912

Equatorial coordinates:	**Equinox:**
R.A.= $19^h38^m41\overset{s}{.}18$ **DEC.=** $+54°58'25\overset{''}{.}7$	J2000

Comparison star(s):	HD 184240

Check star(s):	HD 186239

Observatory and telescope:
51-cm Cassegrainian telescope of Biruni Observatory at Shiraz University, Shiraz, Iran

Detector:	Unrefrigerated RCA4509 photomultiplier tube

Filter(s):	*B* and *V* bands of Johnson system

Transformed to a standard system:	No

Type of variability:	Eclipsing binaries with apsidal motion

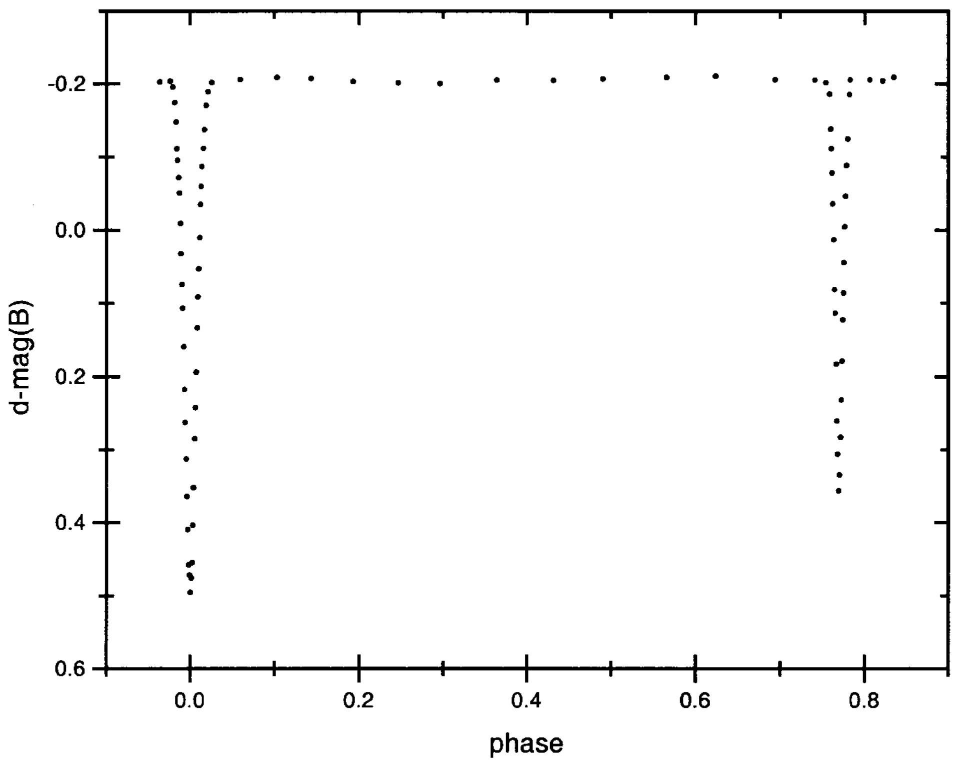

Figure 1. Light curve of DI Herculis in B filter

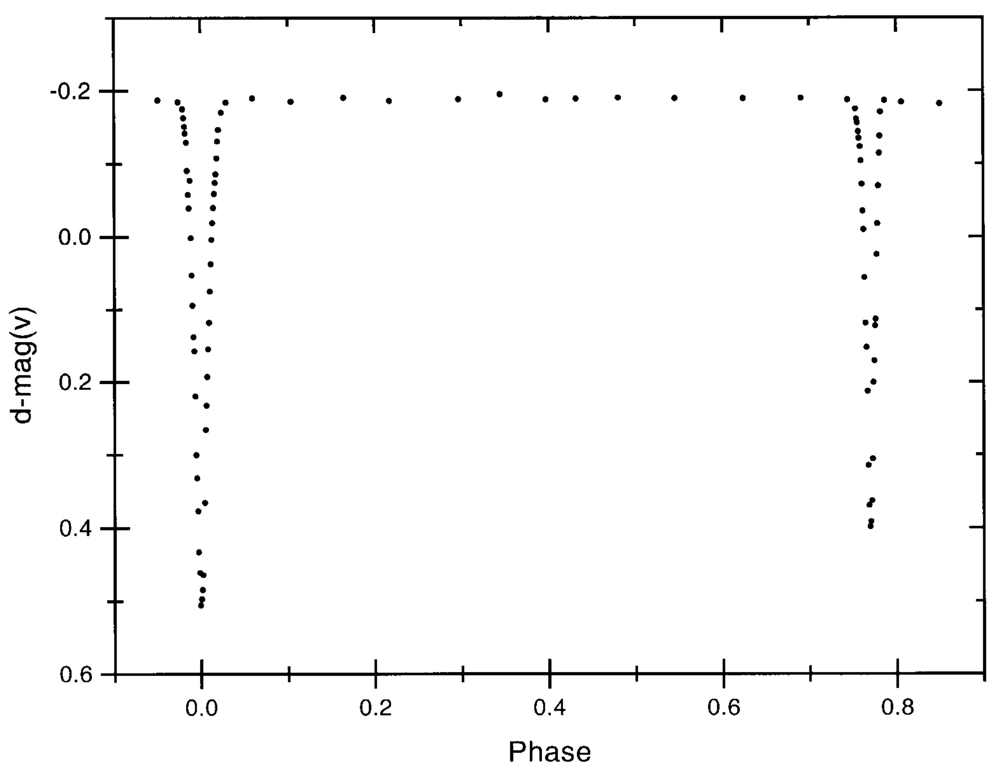

Figure 2. Light curve of DI Herculis in V filter

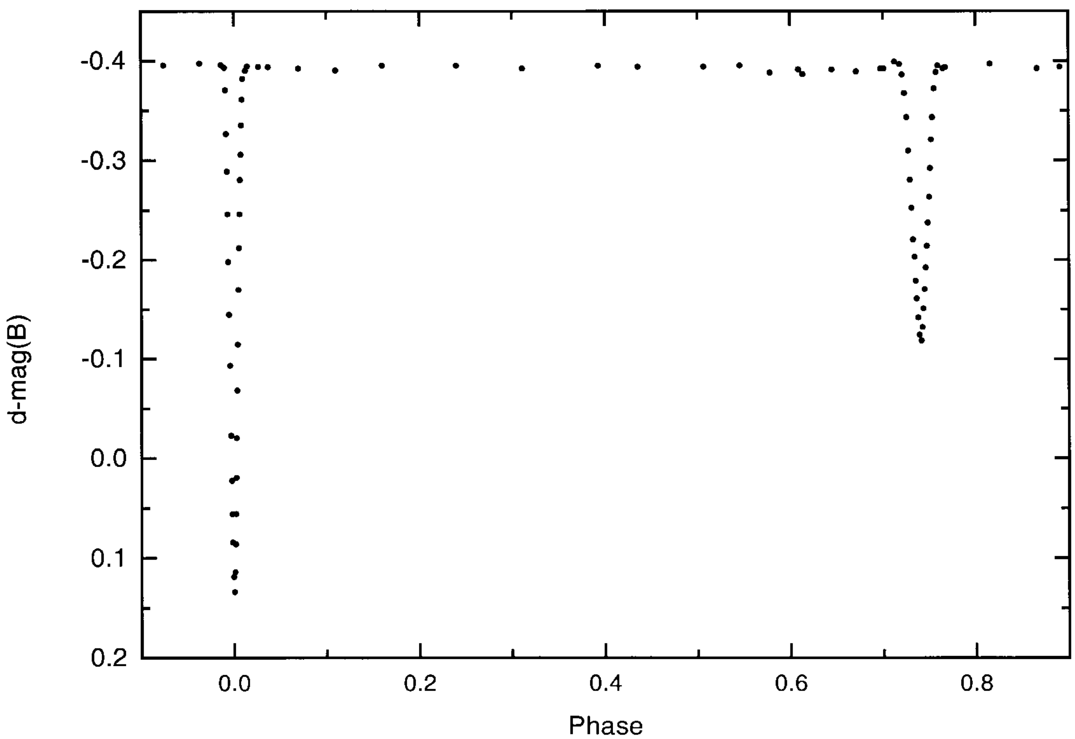

Figure 3. Light curve of V1143 Cygni in B filter

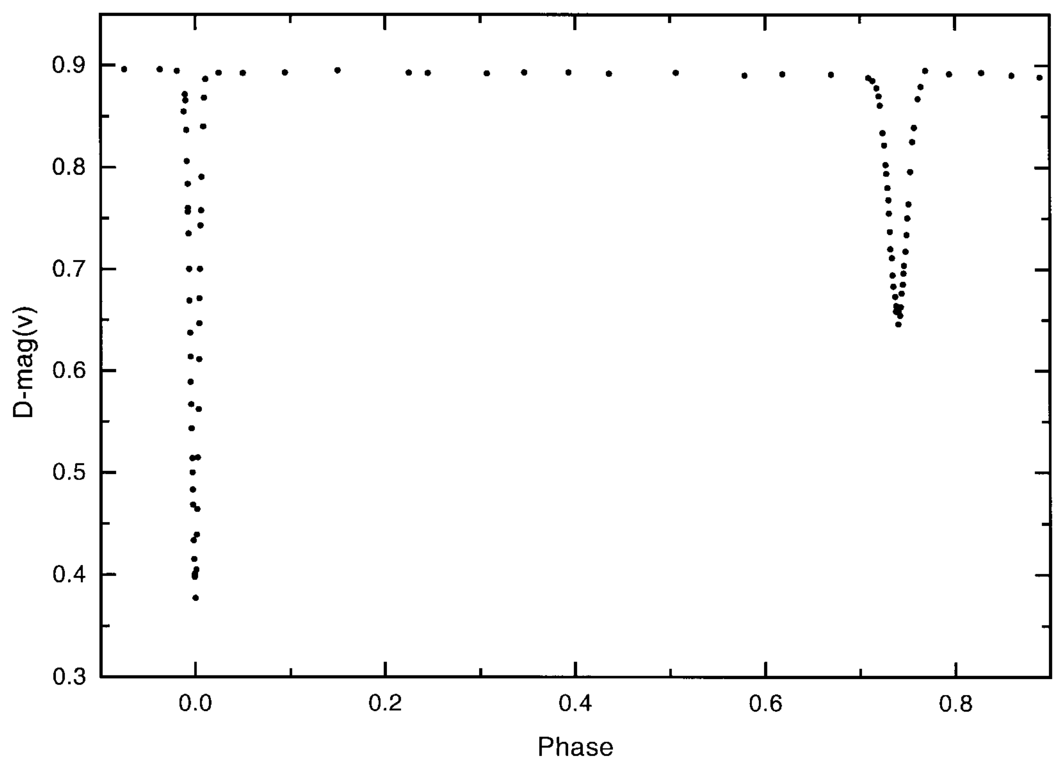

Figure 4. Light curve of V1143 Cygni in V filter

Table 1: The photoelectric times of minima

System	Min. type	Heliocentric JD 2400000 +
DI Her	I	$51781.25030 \pm .00021$
DI Her	II	$51789.37072 \pm .00081$
V1143 Cyg	I	$51771.34410 \pm .00066$
V1143 Cyg	II	$51792.28645 \pm .00220$

Table 2: The depth of minima, according to the present study

System	Filter	Min. I	Min. II
DI Her	B	$0\overset{m}{.}70 \pm 0.01$	$0\overset{m}{.}55 \pm 0.01$
DI Her	V	$0\overset{m}{.}69 \pm 0.02$	$0\overset{m}{.}58 \pm 0.02$
V1143 Cyg	B	$0\overset{m}{.}53 \pm 0.01$	$0\overset{m}{.}25 \pm 0.01$
V1143 Cyg	V	$0\overset{m}{.}48 \pm 0.02$	$0\overset{m}{.}23 \pm 0.02$

Remarks:

DI Herculis and V1143 Cygni are stars with apsidal motion, moving in highly eccentric orbits. The eccentricities are 0.49 and 0.54 for DI Herculis and V1143 Cygni, respectively (Guinan and Maloney, 1985). The observations were made during the summer of 2000. Heliocentric times of minima were computed by fitting a Lorentzian function to the minima. Uncertainties were estimated from the combined errors in the two filters. Table 1 presents the derived times of minima (I for primary and II for secondary). The depths of minima in each filter are presented in Table 2. The probable errors of the individual observation were estimated from an examination of the scatter in the outside eclipse portions of the light curves. Finally, the observed light curves of DI Herculis and V1143 Cygni in B and V filters are plotted in Figures 1–4. These light curves are calculated according to the ephemeris of Guinan et al. (1994) for DI Herculis and of Lacy and Fox (1994) and Andersen et al. (1987) for V1143 Cygni.

$$\text{Min. I (DI Herculis)} = \text{HJD } 2449491.8622 + 10\overset{d}{.}55016766 \times E;$$
$$\text{Min. I (V1143 Cygni)} = \text{HJD } 2449234.6144 + 7\overset{d}{.}64075217 \times E.$$

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ON THE IDENTIFICATIONS OF V391 Sct, V2435 Sgr AND MAFFEI'S INFRARED VARIABLES

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V391 Sct is one of new variable stars discovered by Maffei (1975). The object was classified as a possible dwarf nova by Maffei (1975). However, owing to the lack of a finding chart, the exact identification remained uncertain. Downes et al. (1997) even considered the variable to be lost.

The reason of the difficulty of finding an identification has been partly because that Maffei (1975) used infrared plates to search for variable stars. Many of new variable stars by Maffei (1975) are not registered in USNO catalogs, probably because of their red colors and interstellar extinction. The recent release of 2MASS point source catalog (released by IPAC/UMass 2000) has removed much of these difficulties. A sample extraction of variable stars by Maffei (1975) has revealed that remarkably bright infrared sources are almost always present at the exact locations reported by Maffei (1975), making unique identifications possible. Table 1 lists all objects in the table of Maffei (1975) which have 2MASS counterparts brighter than $J = 11$ and $K_s = 9$. However, the 2MASS release has covered only a small part of the survey by Maffei (1975), which does not contain the field of V391 Sct. The most recent release of the Midcourse Space Experiment (MSX5C) Point Source Catalog (Egan 1999) has dramatically improved this situation. The author has found many variables by Maffei (1975) have conspicuous MSX5C counterparts, as are also listed in Table 1.

The author noticed the presence of MSX5C G016.1479-02.1803 at the exact location reported by Maffei (1975). Based on secure identifications of other variables with MSX5C sources, we consider that this MSX5C source is the true counterpart of V391 Sct. The source is subsequently identified with a GSC star (GSC 6266.2259) with $V = 12.8$, not resolved in the USNO catalog. A large difference between the USNO r magnitude of 15.5 (combined magnitude with a nearby star) and the GSC value also supports that the optical counterpart is a large-amplitude variable star. Combined with the infrared detection, the object is most likely a large-amplitude, Mira-type variable. Table 2 lists the reported positions in J2000.0.

V2435 Sgr is one of variables discovered by Oosterhoff and Ponsen (1968), and was classified as a possible dwarf nova. The author noticed that the object is identified with a bright 2MASS star ($J = 9.63$, $H = 8.50$, $K_s = 8.14$) and a variable star ISOGAL P J175855.1-290037 with a $\log P(\mathrm{d}) = 1.718$ detected by the ISOGAL project (Schultheis et al. 2000). These identifications have not been reported in the previous literature. The

Table 1: Maffei's objects identified with bright 2MASS sources

No.[a]	Object	2MASS position[b]		MSX5C[b]		Maffei[b]	
2	GU Ser	$18^{h}09^{m}39^{s}.53$	$-14°55'38''.9$	39.5	44	39.5	37
3	GO Ser	18 08 51.93	−14 08 33.3	51.8	37	51.6	31
15	V405 Sct	18 29 22.48	−15 07 59.8	22.5	57	22.7	57
30	GH Ser	18 08 21.56	−15 24 01.9	21.8	05	22.1	02
31	GL Ser	18 08 34.39	−15 07 38.6	-	-	34.8	37
32	GN Ser	18 08 40.03	−15 09 39.3	-	-	39.8	36
65	V404 Sct	18 29 12.84	−15 37 37.7	-	-	12.3	40
67	V400 Sct	18 28 42.36	−15 22 52.6	42.3	51	42.0	53
76	V421 Sct	18 30 50.93	−15 37 29.0	-	-	51.3	29
77	V424 Sct	18 31 36.26	−15 26 58.2	36.3	58	36.1	56
78	V422 Sct	18 31 25.26	−15 18 22.7	25.2	22	24.9	20
79	V402 Sct	18 29 00.73	−14 43 55.1	00.9	51	01.2	52
80	V401 Sct	18 28 54.18	−14 29 20.2	54.2	16	53.9	20
84	V415 Sct	18 03 13.42	−14 25 19.2	13.5	17	13.8	16
90	GI Ser	18 08 26.39	−15 35 11.9	26.3	11	26.4	06
92	GM Ser	18 08 35.81	−15 04 01.6	35.7	03	35.7	59
100	GQ Ser	18 09 18.03	−14 38 12.7	17.8	15	18.2	10
101	GG Ser	18 08 11.04	−14 34 27.9	10.9	30	12.1	19
102	FY Ser	18 07 53.49	−14 31 26.4	53.4	30	54.0	24
103	GK Ser	18 08 25.49	−14 18 07.7	25.2	10	25.8	06
104	GT Ser	18 09 34.93	−14 26 40.8	34.7	42	34.9	38
134	V406 Sct	18 29 23.30	−15 47 34.8	23.7	25	23.5	29
135	V407 Sct	18 29 32.18	−15 48 39.6	32.1	40	32.5	40
136	V413 Sct	18 30 02.33	−15 28 30.1	02.3	28	02.1	30
137	V414 Sct	18 30 13.85	−15 27 22.4	13.7	21	14.1	23
151	V409 Sct	18 29 40.00	−14 00 17.9	-	-	40.3	18
152	V412 Sct	18 29 58.81	−14 10 10.3	58.9	08	58.5	11
153	V419 Sct	18 30 36.29	−14 16 24.9	36.4	19	36.6	21
154	V418 Sct	18 30 28.97	−14 21 35.4	29.2	33	28.7	34
163	GP Ser	18 09 09.81	−15 51 20.2	09.7	19	09.7	19
164	GR Ser	18 09 24.40	−15 19 36.4	24.3	36	24.0	32
165	NSV10266	18 09 06.05	−15 18 37.2	-	-	06.0	34
172	NSV10251	18 08 36.17	−14 47 34.1	-	-	36.4	34
173	FZ Ser	18 08 01.93	−14 44 15.0	01.7	16	02.3	09
174	NSV10271	18 09 14.51	−14 29 48.4	14.4	50	14.0	46
198	V403 Sct	18 29 02.73	−14 46 58.3	02.9	55	02.2	56
199	V410 Sct	18 29 53.01	−14 57 53.4	53.0	52	53.5	52
200	V425 Sct	18 34 42.33	−15 12 14.3	42.2	13	41.7	12
201	V408 Sct	18 29 38.97	−14 46 12.4	-	-	39.2	08
202	V417 Sct	18 30 15.72	−14 31 26.6	15.8	24	15.9	25
205	V416 Sct	18 30 14.76	−14 21 33.9	14.9	30	14.7	33
206	V423 Sct	18 31 25.23	−14 43 50.3	25.3	47	25.2	47

[a] Maffei Var. Number (Maffei 1975); [b] J2000.0 position

Table 2: Positions of V391 Sct

Source	R.A.	Decl.
Maffei	$18^{\rm h}28^{\rm m}06\overset{\rm s}{.}7$	$-15°54'49''$
MSX5C	18 28 06.6	−15 54 42
GSC 1.1	18 28 06.6	−15 54 45

Table 3: Positions of V2435 Sgr

Source	R.A.	Decl.
Original[a]	$17^{\rm h}58^{\rm m}54\overset{\rm s}{.}98$	$-29°00'37\overset{''}{.}8$
2MASS	17 58 54.98	−29 00 37.8
ISOGAL	17 58 55.1	−29 00 37

[a] Position by Downes et al. (1997), based on the chart in Oosterhoff and Ponsen (1968)

variable is thus a long-period variable rather than a dwarf nova. Table 3 lists the reported positions in J2000.0.

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THE LIGHT CURVE AND RED SPECTRUM OF NOVA V4643 Sgr IN EARLY DECLINE

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V4643 Sgr (Nova Sgr 2001) was discovered by Liller (2001) on 2001, Feb. 24. The light curve compiled from magnitude estimates published in IAU Circulars and observations of members of the V.S.S. of the R.A.S.N.Z. (Fig. 1) shows it to be a very fast nova. A parametric fit of a second order polynomial to the first part of the light curve (shown as a dashed line in Fig. 1) indicates that it takes $t_2 = 4.8$ days ($t_3 = 8.6$ days) for the nova to decline 2 (3) magnitudes from maximum light, assuming the first point on the light curve corresponding to outburst maximum.

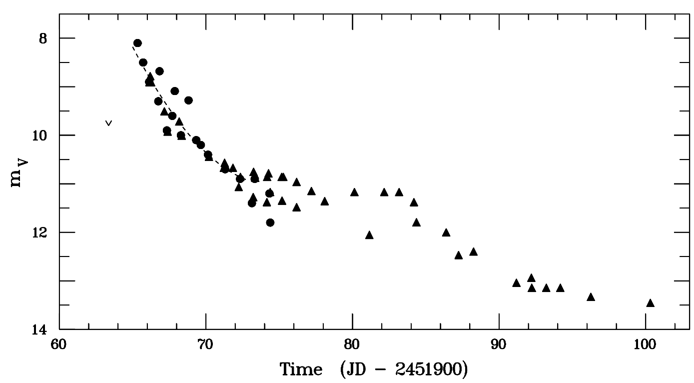

Figure 1. Early decline visual light curve of V4643 Sgr. Dots are magnitude estimates published in IAU Circulars; triangles are observations of members of the V.S.S. of the R.A.S.N.Z. The dashed line is a parametric second order polynomial fit to the data. The chevron indicates the epoch of the last negative observation before discovery

The absolute magnitude of V4643 Sgr during maximum can be estimated using the maximum magnitude–rate of decline (MMRD) relation of which many versions are published in the literature (Schmidt-Kaler 1957, Pfau 1976, de Vaucouleurs 1978, Cohen 1988, Capaccioli et al. 1989, Della Valle 1991). Disregarding the slight dependence on the photometric band, and rejecting a discrepant result based on the Capaccioli et al. relation, all others yield a mean absolute magnitude at maximum of $M = -9\overset{m}{.}04 \pm 0\overset{m}{.}08$. The error of the mean is significantly smaller than the error of the individual relations. Thus, there is no point in preferring one relation over the other and I adopt the mean as the best result. Together with the apparent magnitude of the first point in the light curve, $m = 8\overset{m}{.}1$ (to which I arbitrarily assign an error of $0\overset{m}{.}1$), this yields a distance of $d = 2900 \pm 170$ pc. Since the interstellar extinction towards V4643 Sgr is unknown and consequently is not considered here, this distance should be regarded as an upper limit.

The various determinations of the absolute magnitude M_{15} of novae 15 days after maximum (Buscombe & de Vaucouleurs 1955, Schmidt-Kaler 1957, Pfau 1976, de Vaucouleurs 1978, Cohen 1985, van den Bergh & Younger 1987, van den Bergh 1988, Capaccioli et al. 1989) predict $M_{15} = -5\overset{m}{.}53 \pm 0\overset{m}{.}24$. The light curve of V4643 Sgr at this epoch exhibits substantial scatter permitting only to roughly estimate $m_{15} = 11\overset{m}{.}7 \pm 0\overset{m}{.}5$ as the apparent magnitude 15 days after maximum. This is $3\overset{m}{.}6$ fainter than the first point on the light curve which thus corresponds to $M = -9\overset{m}{.}1$, well compatible with the results obtained from the MMRD relation, suggesting that the first observation of V4643 Sgr has been obtained close to maximum light. The error being significantly larger than in the case of the MMRD relation, m_{15} cannot yield an improved distance estimate.

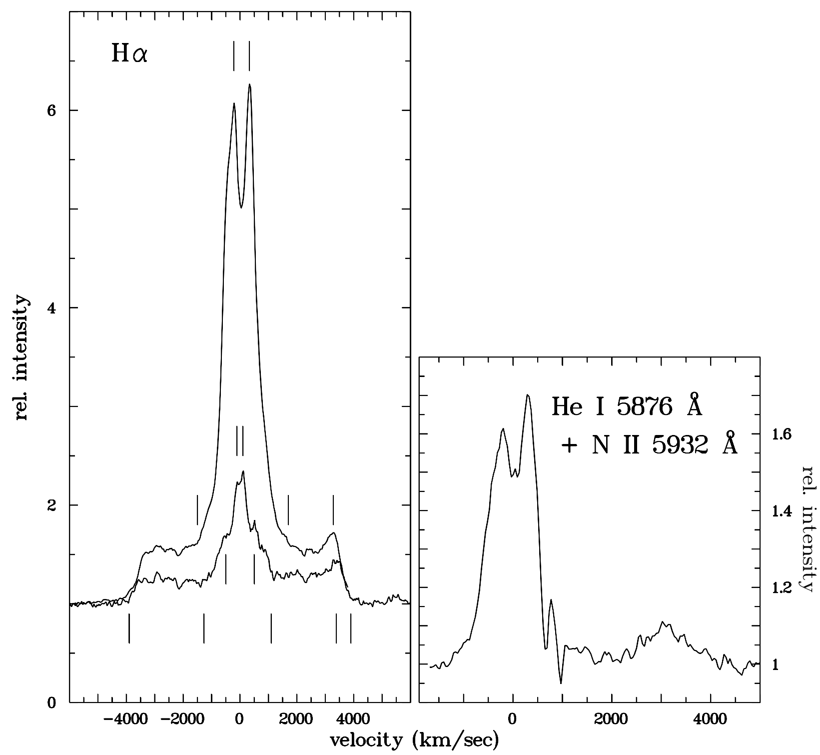

Figure 2. Emission line profiles of Hα (stronger line: 2001, March 16; fainter line: 2001, May 4) and He I λ 5876 Å (plus N II λ 5932 Å; 2001 March 16) in the spectra of V4643 Sgr on a velocity scale. Vertical bars indicate the location of features for which radial velocities are quoted in the text

Spectra of V4643 Sgr in the range of Hα were obtained at the 1.6-m telescope of the Laboratório Nacional de Astrofísica, Brazil on 2001, March 16 (JD 2451984.80; day 19 after maximum; two exposures; 20 min total integration time) when the visual magnitude had dropped to $m_{\rm v} \sim 11.5$, and on 2001 May 4 (JD 2452033.75; day 68; three exposures; 45 min total integration time; visual magnitude unknown, probably $\sim 14^m$). A Cassegrain spectrograph equipped with a thin, back-illuminated SITeSI003AB CCD was used to record the spectra. The instrumental setup yielded a resolution (FWHM) of 2.1 Å. The spectral coverage ranged from 5843 Å to 6624 Å on March 16, and from 5924 Å to 6664 Å on May 4.

The spectra are dominated by strong and complex Hα emission which exhibits appreciable differences between the two observing epochs. The profiles, normalized to the continuum, are shown on a velocity scale in Fig. 2 (left). During both nights Hα consists of a very broad, almost flat component underlying a much narrower strong central emission. The most obvious difference between the observing epochs is the line strength (with respect to the continuum) which is much stronger earlier in the outburst than later on. On March 16 the narrow component exhibits two peaks which, however, at -220 km sec^{-1} and $+330$ km sec^{-1} (these and the subsequently quoted velocities are marked by small vertical bars in Fig. 2) are not symmetrical to the rest wavelength. The full width of the central emission is about 3200 km sec^{-1} (ranging from -1500 km sec^{-1} to 1700 km sec^{-1}). The broad component reaches out to ± 3900 km sec^{-1} from the rest wavelength. It appears to be essentially flat with some low scale structure, in particular a red peak at 3280 km sec^{-1}. The overall line profile resembles very much the profile of emission lines of Nova Ophiuchi 1998 a few days after outburst (Lynch et al. 2000).

On May 4 the total width of the broad component is practically unchanged but the equivalent width has decreased by a factor of more than 2. Details of its structure are largely preserved, with the red peak now appearing at a slightly higher radial velocity: 3390 km sec^{-1}. The equivalent width of the narrow component has decreased by a factor of more than five, much more than the broad component. It exhibits more fine-structure than during the earlier epoch: there are peaks (or shoulders) at -110 km sec^{-1}, $+100$ km sec^{-1} and ± 500 km sec^{-1}. Furthermore, the total width of the narrow component has decreased to 2370 km sec^{-1} (ranging from -1270 km sec^{-1} to 1100 km sec^{-1}).

The only other spectral features unambiguously present in the spectrum of March 16 are emissions of He I λ 5876 Å and N II λ 5932 Å as well as absorption lines of Na I $\lambda\lambda$ 5890, 5896 Å, shown in the right frame of Fig. 2 on a velocity scale centered on the rest wavelength of the helium line (note the different intensity scale as compared to the left frame of the figure). This spectral range was only observed on March 16. Just as in Hα the structure of the He I λ 5876 Å emission is double-peaked with a peak separation consistent with that seen in Hα. The broad, flat component is not discernible, probably because its blue edge is beyond the observed spectral range and the red edge is beneath the N II λ 5932 Å emission. This makes it difficult to properly define the continuum level in this wavelength range. The nitrogen line is faint and thus noisy, but it is probably safe to say that it does not show a double peak. Therefore, its place of origin is not the same as that of the hydrogen and helium lines. Sharp Na I $\lambda\lambda$ 5890, 5896 Å lines cut into the red flank of the He I line. They are clearly of interstellar origin. They radial velocity is -48 km sec^{-1}. The spectrum of May 4 shows (in a range not covered on March 16) a faint emission of He I λ 6678 Å, seen as a small hump at the extreme right of the left frame of Fig. 2.

The equivalent widths (EWs) of the emission lines were measured and are listed in Table 1. In the case of Hα the EW of the entire line as well as of the broad and narrow components are listed. The EW of the sodium absorption lines cannot reliably be measured because they are superposed upon the steep red flank of the helium emission.

Qualitatively, the morphology of the Hα emission can be explained if the mass was not ejected spherically during the nova outburst but mainly in the equatorial plane of the white dwarf and in the polar regions. Such an outburst geometry is suggested by the nebular remnants of numerous other novae (although Slavin et al. (1995) found this type of morphology preferable in slower novae). If the inclination of the rotation axis to the

Table 1: Equivalent width (in Å) of emission lines observed in V4643 Sgr

Line	2001, March 16	2001, May 4
Hα (entire line)	219	68
Hα (broad component)	95	45
Hα (narrow component)	123	23
He I λ 5876 Å	15	–
He I λ 6678 Å	–	0.8
N II λ 5932 Å	1.9	–

line of sight is high (but not high enough for the approaching part of the matter ejected in the equatorial plane to prevent the view of the receding part) the broad component should be interpreted as being emitted by an equatorial ring. The narrow component is then due to matter ejected along the polar axis which (even if the true velocity is comparable to that of the equatorially ejected matter) has a smaller radial velocity due to the higher angle with respect to the line of sight. The two peaks in the narrow component which are clearly present early on in the outburst then indicate emission from opposite polar ejecta.

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A DEEP DIP DURING AN OUTBURST IN THE OLD NOVA, Q CYGNI

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Q Cyg is an old fast nova ($t_3 \sim 11$ d) which reached $V = 3^{\rm m}$ at the maximum of the 1876 outburst. In quiescence after the outburst ($V \sim 15^{\rm m}$) this object has been revealed to show large-amplitude modulations, which are called "stunted" outbursts by Honeycutt et al. (1998, and see references therein for earlier studies on this behavior). Honeycutt (2001) listed that the mean amplitude, the typical spacing, and the mean full-width-at-half-maximum (FWHM) of outbursts are $1\overset{\rm m}{.}0$, about 200 d, and 24 d, respectively. Although $\sim$ 10 old novae other than Q Cyg is now known to exhibit such "stunted" outbursts (Honeycutt 2001), the mechanism is still a mystery. To investigate the accretion disk in outburst, we carried out time-resolved photometry during an outburst in 1994, detected by T. Vanmunster (private communication).

We made the observations at Ouda Station, Kyoto University. A 60-cm reflector (focal length = 4.8 m) and a CCD camera (Thomson TH 7882, 576×384 pixels with on-chip 2×2 binning) attached to the Cassegrain focus were used (for more information of the instruments, see Ohtani et al. 1992). We adopted a Johnson V-band interference filter. Table 1 gives the journal of the observations. After standard de-biasing and flat fielding, the frames were processed by a microcomputer-based aperture photometry package developed by one of the authors (TK).

The magnitudes of the object were measured relative to a local standard star, Q Cyg–31 ($V = 13.375$, $B-V = +0.754$) in Henden and Honeycutt (1997). Heliocentric corrections to observed times were applied before the following analysis. Relative magnitudes between the comparison star and a local field star were measured to confirm the constancy of the comparison star within $0\overset{\rm m}{.}04$ during our runs and to calculate the errors listed in Table 1.

The long-term light curve derived from our observations of this outburst is drawn in Figure 1. This is of a typical decline shape of outburst in Q Cyg, while the decline rate of 0.07 mag d^{-1} is a little large for this star (cf. Honeycutt et al. 1998). In our observations, we could not detect any short-term periodic modulations, such as superhumps and quasi-period oscillations (QPOs), in a period range of 0.002–0.2 d.

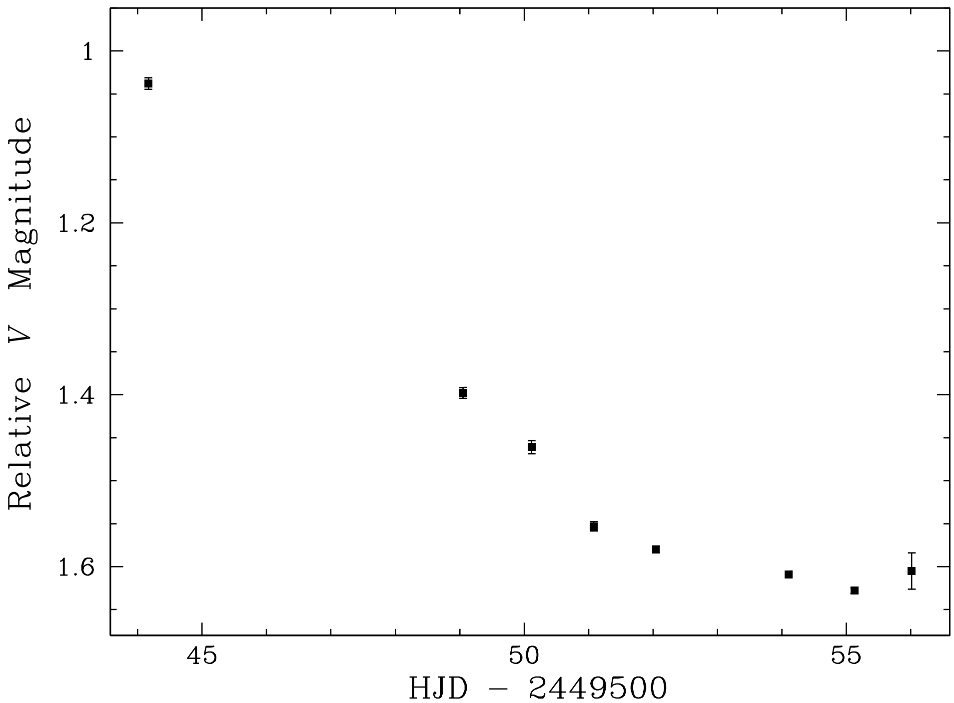

Figure 1. Light curve of Q Cyg between 1994 July 10 and 22

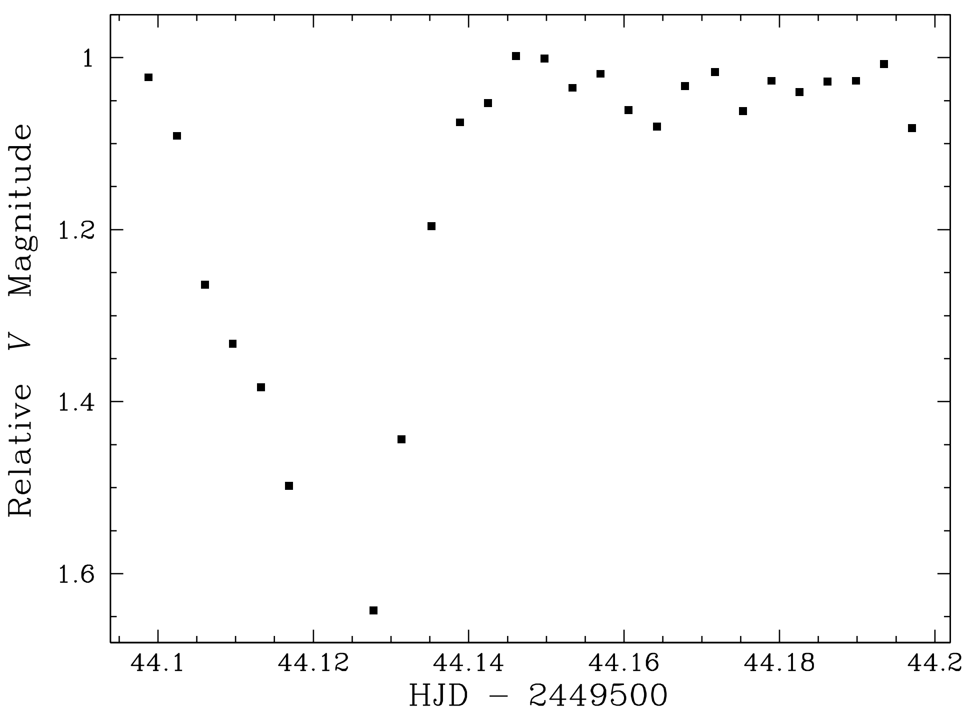

Figure 2. The deep dip observed on 1994 July 10

Table 1: The observation summary

Date	HJD start[1]	HJD end[1]	Exposure time (s)	Error[2]	Mean V mag[3]	N[4]
1994 July 10	49544.098	49544.200	300	0.03	1.038	17
15	49548.987	49549.106	100	0.03	1.398	87
16	49550.096	49550.132	180	0.03	1.461	16
17	49551.029	49551.131	90	0.05	1.553	82
18	49551.966	49552.130	90	0.05	1.580	134
20	49554.003	49554.255	90	0.05	1.609	149
21	49554.961	49555.269	90	0.05	1.628	230
22	49555.975	49556.059	100	0.14	1.605	47

[1] HJD – 2400000
[2] Nominal error for 1 point
[3] Magnitude relative to a local standard star ($V = 13.375$)
[4] Number of frames

The most remarkable feature in our data is a deep dip ($\triangle m \simeq 0.65$) with a duration of about 1 hour observed on 1997 July 10 (Figure 2). We examined the original images to reject the possibilities of effects of clouds and other natural/artificial factors and ensured the existence of the dip. Although two similar dips were detected in Q Cyg by Honeycutt et al. (1998), the dip in the present data seems to have a different nature than those dips because of two reasons: 1) the duration was quite different (1 hour versus several-tens of days), and 2) the dip in our data occurred in a bright phase, but those dips were observed in "quiescence", following two separate outbursts.

This may be an eclipse of the accretion disk by the secondary star. This interpretation is, however, not plausible, since the low inclination angle is implied by the fact that any orbital feature has never been detected in spite of the long observational history of this old nova. There is another possibility of an eclipse by the third body, although its orbit may be needed to be more inclined from the orbital surface of the primary and the secondary stars and the duration may be too short. The third possibility is a transient increase of absorption by mass sporadically ejected (cf. BZ Cam, Ringwald & Naylor 1998; AT Cnc, Nogami et al. 1999). To solve this difficult problem and to understand the nature of the oscillations in old novae, we would encourage extensive time-series photometry and spectroscopy to seek for orbital feature and an evidence of mass ejection.

We thank Mr. Maehara and Mr. Baba for kind helping our observations at Ouda Station.

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THE IDENTITY OF XY Psc

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XY Psc is a variable star discovered by Rosino and Pigatto (1972a, RP72a) with the 40/50 cm Asiago Schmidt telescope during the course of the Asiago Supernova Survey. It was initially thought to be a supernova in the faint galaxy UGC 729. XY Psc was observable on films taken on October 5, 1972 (estimated at $m_{\rm pg} = 13.0$) and October 17, 1972 (at $m_{\rm pg} = 15.0$), but not on films taken before or after (with $m_{\rm pg}$ limiting magnitudes around 18.5). Deming et al. (1972) failed to find the object on plates taken at Prairie Observatory on October 27, 1972 (limiting magnitude $B = 17$). It was also not found on POSS-I prints, yielding a deeper quiescent magnitude of about $B = 20$. Based on this rapid rise and decline and the large amplitude, Rosino and Pigatto (1972b, RP72b) suggested that the object was a U Gem cataclysmic variable of large amplitude and long period.

Downes and Shara (1993, DS93) give a finding chart with a faint star marked. Downes, Webbink and Shara (1997, DWS97) give essentially the same position, with a note that the star is at or below the plate limit and the coordinates are approximate. Visual observation of this field began in 1980 with the issue of a finding chart by Bateson et al. (1980). No outbursts have been detected since that date by VSNET, AAVSO or VSS RASNZ observers.

A deep image with the USNO Flagstaff Station (USNOFS) 1.0-m telescope (limiting magnitude around $V = 24$), shown in Figure 1, shows a faint blue object near the RP72a coordinates. To further confirm the identity, we used the USNOFS PMM to scan four film pairs from the Asiago Schmidt. Each pair consists of a 5-minute 103aO film exposure along with a 15-minute TriX Pan film exposure. These correspond roughly to B and V filtration. One film pair was taken on August 12 (before the outburst), one pair was taken on October 30 (after the outburst), and the other two film pairs are the ones reported in RP72a and RP72b. After scanning, accurate coordinates and instrumental magnitudes were extracted for all objects including XY Psc. The four outburst scans were added to create the finding chart shown in Figure 2 (identifying circular marks were left on the films and show faintly in this figure; limiting magnitude is about $V = 18$). Table 1 lists

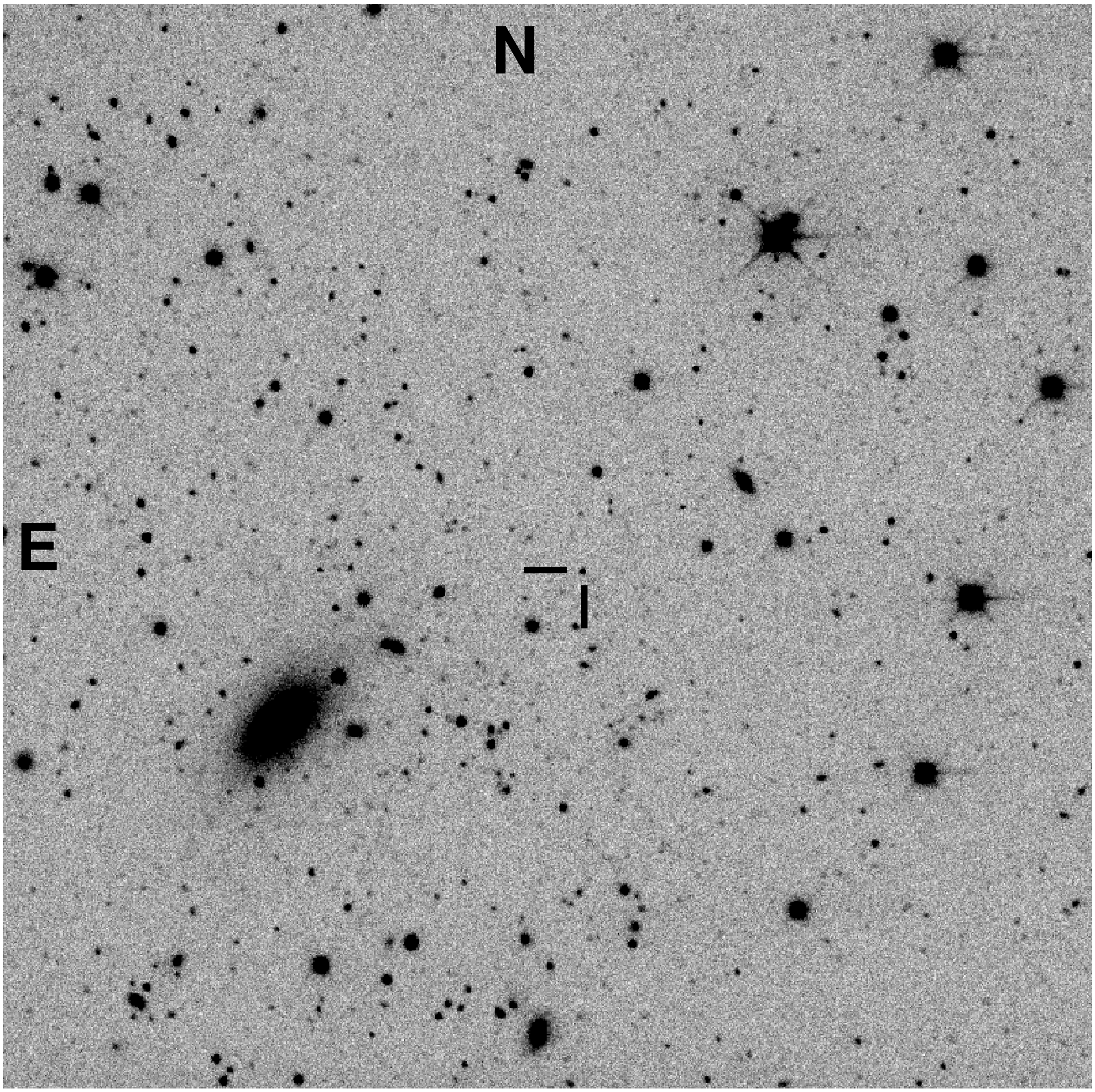

Figure 1. Combined quiescent NOFS CCD image of field. The field of view is $10' \times 10'$

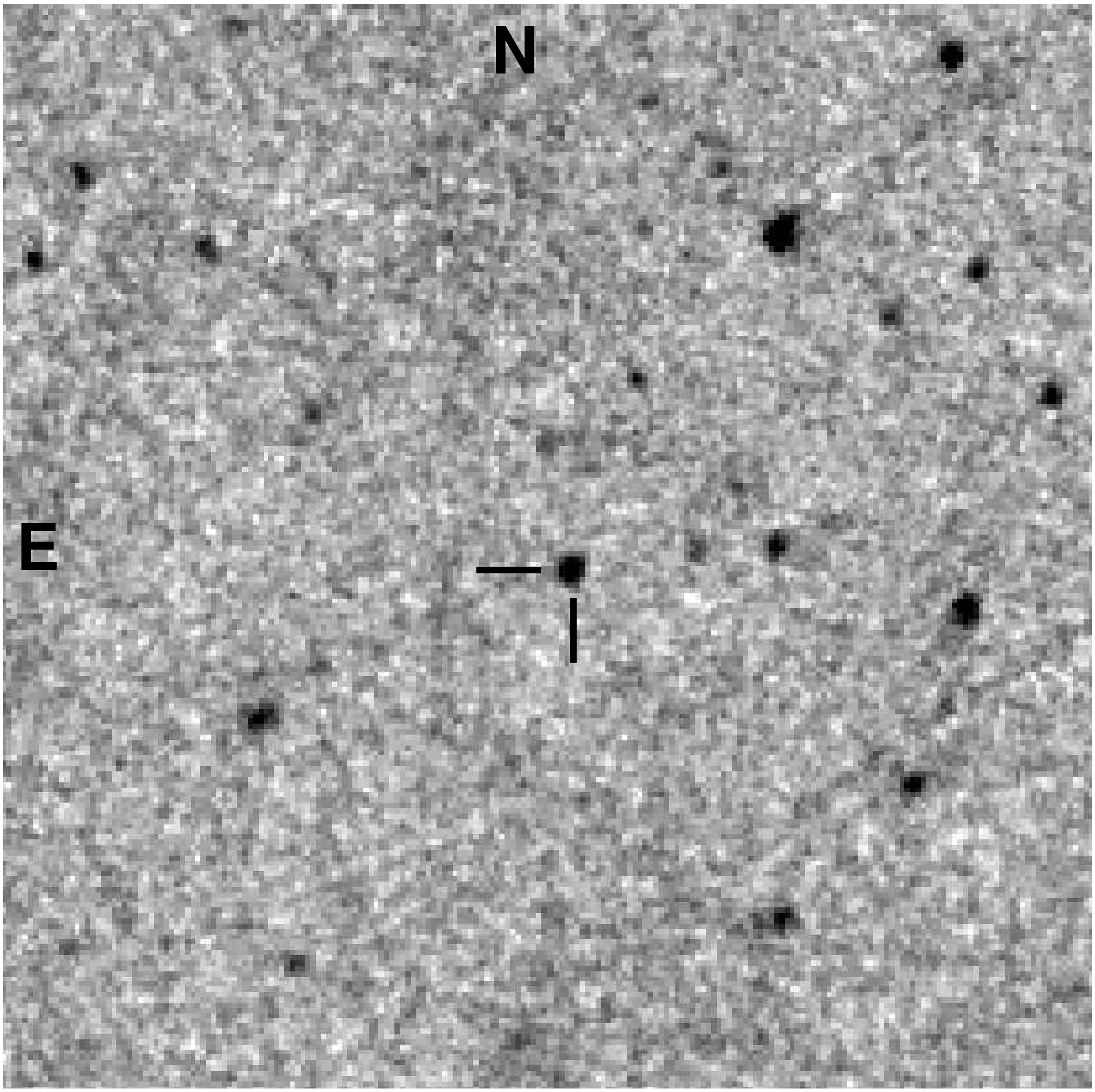

Figure 2. Combined outburst image of field from Asiago films. The field of view is $10' \times 10'$

Table 1: Coordinates for XY Psc

Source	RA(J2000)	Dec(J2000)
RP72a	$01^h10^m12^s$	$+03^\circ32'37''$
DS93	$01^h10^m11^s$	$+03^\circ32'37''$
DWS97	$01^h10^m11^s$	$+03^\circ32'36''$
Outburst/PMM	$01^h10^m11\overset{s}{.}28$	$+03^\circ32'35\overset{''}{.}3$
Quiescent	$01^h10^m11\overset{s}{.}23$	$+03^\circ32'35\overset{''}{.}1$

Table 2: Photometry of XY Psc

Date (UT)	V	$B-V$
720813.0122	< 17.0	–
721005.8958	13.7 ± 0.1	$+0.5 \pm 0.1$
721017.0221	15.2 ± 0.1	$+0.7 \pm 0.1$
721030.8667	< 17.0	–
990813.4681	21.10 ± 0.07	$+0.18 \pm 0.07$
990918.4008	21.10 ± 0.08	-0.02 ± 0.08

the coordinates obtained from the scans, along with the earlier reported locations (RS72a has been precessed) and the CCD deep image position. The film scan position has errors of about one arcsec; the CCD position has $0\overset{''}{.}2$ internal errors. Both measured positions are relative to USNO-A2.0.

The instrumental magnitudes were transformed onto the standard Johnson system using the secondary standards given in Henden (2001). The results are given in Table 2, along with the quiescent CCD photometry.

We restrain here from speculations about the nature of this puzzling object (somewhat too large an outburst for a CV, too faint a maximum for a nova, missing a parent galaxy and too fast for a supernova), which will be discussed elsewhere together with new spectroscopic and photometric observational material.

We gratefully acknowledge the assistance of Dave Monet and Steve Levine in using the PMM plate scanner for measuring the original Asiago films, and D. Moro for locating the films in the Asiago archive.

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THE IDENTITY OF DO Vul

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DO Vul (AN 25.1928) is a variable star discovered by Baade (1928) during his Bergedorfer days. The GCVS lists it as a UG cataclysmic variable with an outburst magnitude of $m_{\rm pg} = 14.0$ and a quiescent magnitude fainter than $m_{\rm pg} = 17.4$. Skiff (1997), in acquiring proper identification for Baade's variables, found that most of Baade's positions in the Sagitta field were quite accurate, with typical errors less than 2 arcsec. However, Skiff could not locate DO Vul at the Baade position on the DSS. Downes and Shara (1993, DS93) identified DO Vul only as the northwestern star of a close faint pair (with a further comment that it could be a faint companion); no additional identification was given in Downes, Webbink and Shara (1997, DWS97) though the coordinates were changed slightly. The identification of DO Vul has been uncertain since this is a crowded field and there has been no modern epoch visual outburst (Mattei 2001). Tsesevich (1978) reported nine faint outbursts ($m_{\rm pg} = 16.0$ to $m_{\rm pg} = 17.1$) in the interval October 1960 through July 1976 on Moscow plates; these bursts were only above the plate limit for a day or less.

During the course of various monitoring studies, we have been able to observe the field for DO Vul and unambiguously determine which star is the variable. Shown in Figure 1 is an image of the field, taken with the MDM Observatory 2.4-m telescope, while DO Vul was at quiescence. Figure 2 shows the same field, taken with the USNO Flagstaff STation 1.0-m telescope, while DO Vul was in outburst (May 19, 1999 UT).

There have been several reported positions for the variable. We list the three normal ones in Table 1, along with our measured (using USNO-A2.0) outburst and quiescent positions. The star originally identified as DO Vul in DS93 lies 2.4 arcsec east of the star identified here; its coordinates are given in Table 1 as well.

The photometry for DO Vul and for the nearby companion is given in Table 2. The field zero point was set from the secondary standards given in Henden (2001).

We would like to thank Bill Fenton for taking the data at MDM.

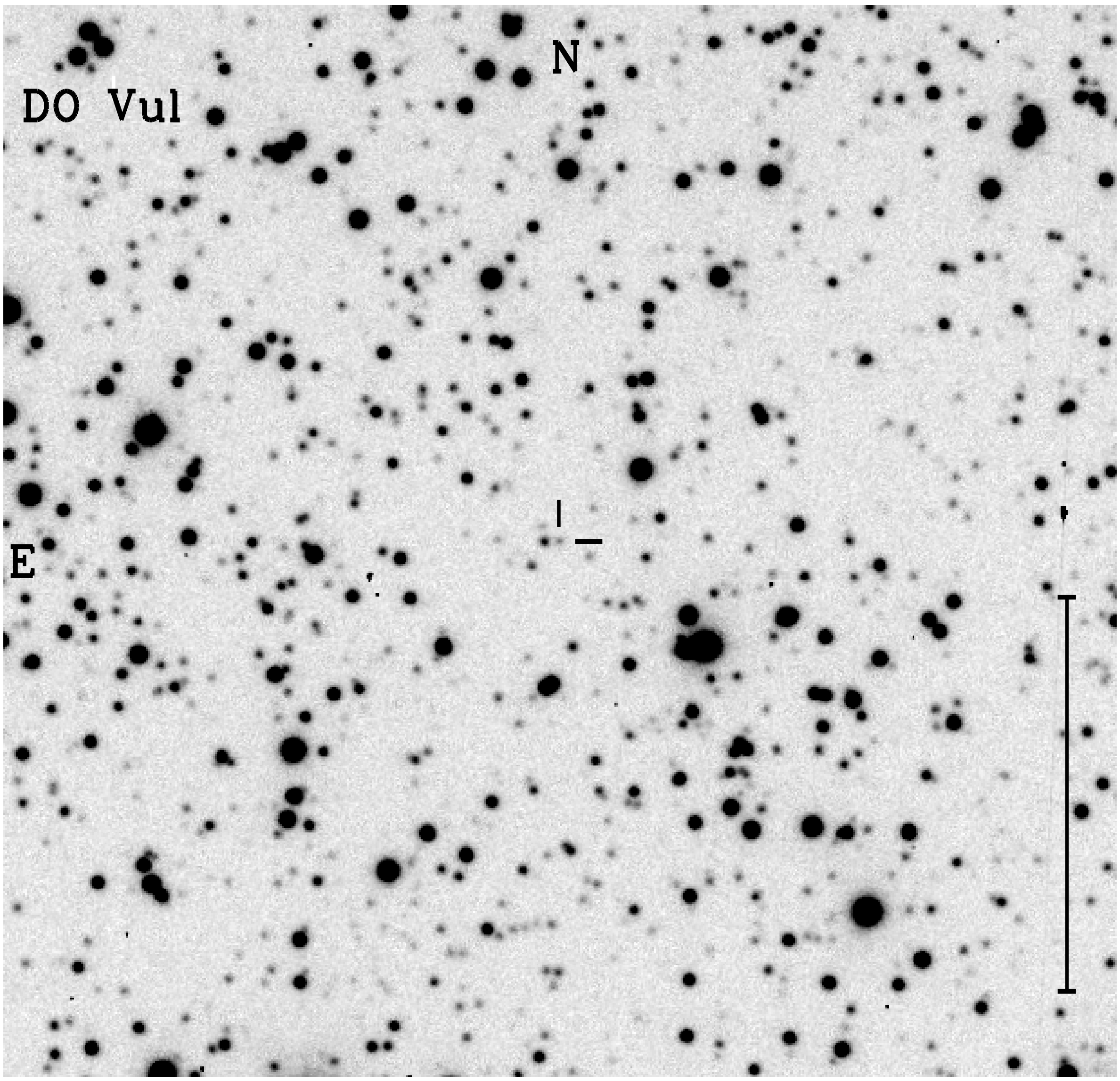

Figure 1. Quiescent V-band image of field on 010522 UT; the scale mark is one arcmin

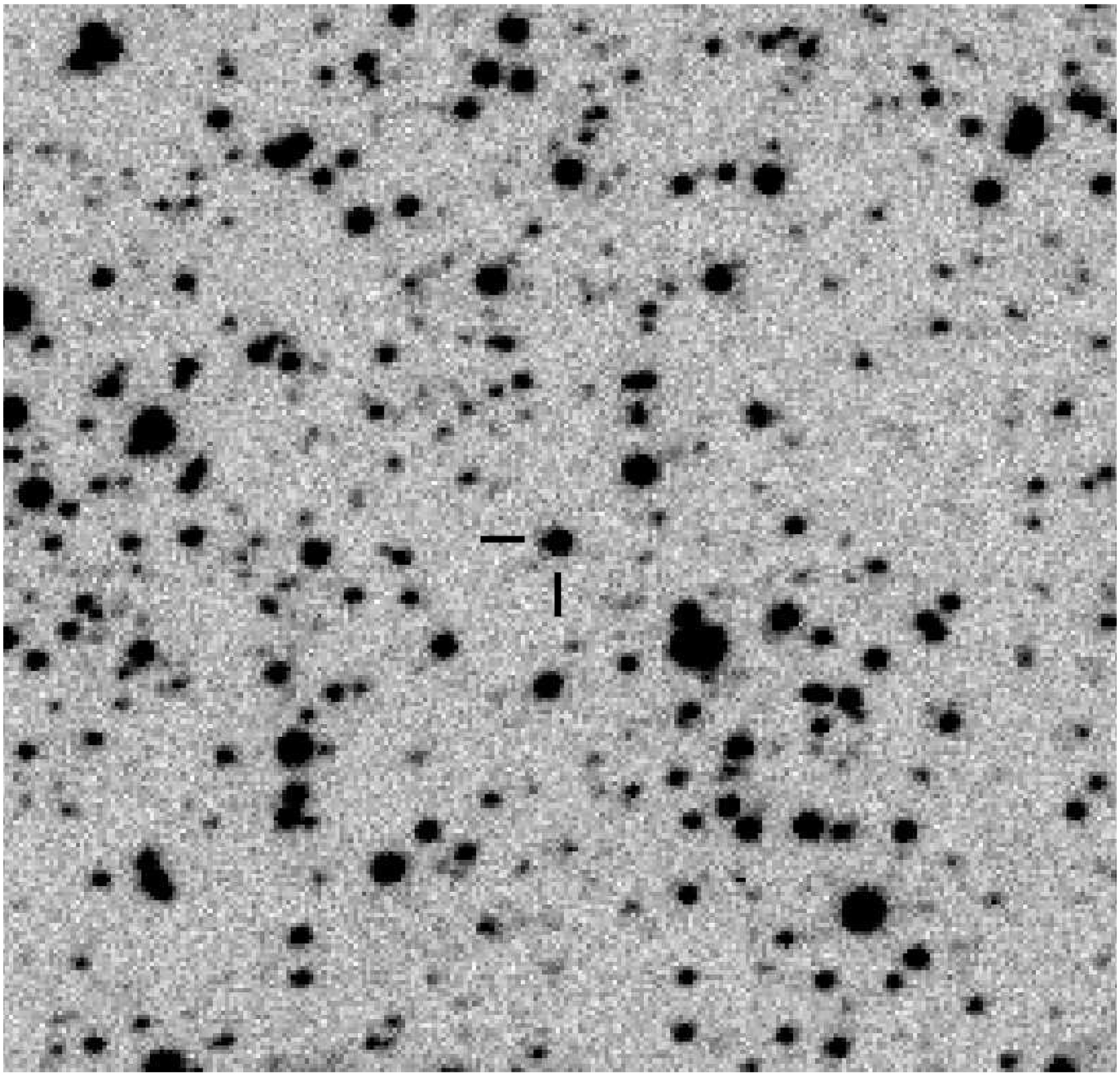

Figure 2. Outburst V-band image of field on 990519 UT

Table 1: Coordinates for DO Vul

Source	RA(J2000)	Dec(J2000)
Baade	$19^{h}52^{m}10\overset{s}{.}6$	$+19°34'44''$
DS93	$19^{h}52^{m}11\overset{s}{.}0$	$+19°34'39''$
DWS97	$19^{h}52^{m}11\overset{s}{.}0$	$+19°34'42''$
Quiescent	$19^{h}52^{m}10\overset{s}{.}71$	$+19°34'42\overset{''}{.}5$
Outburst	$19^{h}52^{m}10\overset{s}{.}74$	$+19°34'42\overset{''}{.}4$
Companion	$19^{h}52^{m}10\overset{s}{.}88$	$+19°34'42\overset{''}{.}4$

Table 2: Photometry of DO Vul

State	V	$B-V$	$U-B$	$V-I$
Quiescent	20.73 ± 0.05	$+0.08 \pm 0.10$	-0.99 ± 0.17	$+0.64 \pm 0.10$
Outburst	16.427 ± 0.016	$+0.167 \pm 0.019$		
Companion	19.670 ± 0.020	$+1.65 \pm 0.06$	$+0.24 \pm 0.36$	$+2.504 \pm 0.021$

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PHOTOELECTRIC OBSERVATIONS OF DR VULPECULAE

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Name of the object:
DR Vul = DM +26°3835 = HD 339770

Equatorial coordinates:	**Equinox:**
R.A.= $20^h13^m46\overset{s}{.}85$ **DEC.=** $+26°45'01\overset{''}{.}59$	2000

Observatory and telescope:
Ege University Observatory (EUO), 48-cm Cassegrain reflector; TÜBİTAK (Scientific and Technical Research Council of Turkey) National Observatory (TNO), 40-cm Cassegrain telescope

Detector:	EMI 9781 A photomultiplier tube of EUO; Hamamatsu R 4457 photomultiplier tube of TNO

Filter(s):	Johnson B and V

Comparison star(s):	BD +26°3827

Check star(s):	BD +26°3837

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	EA

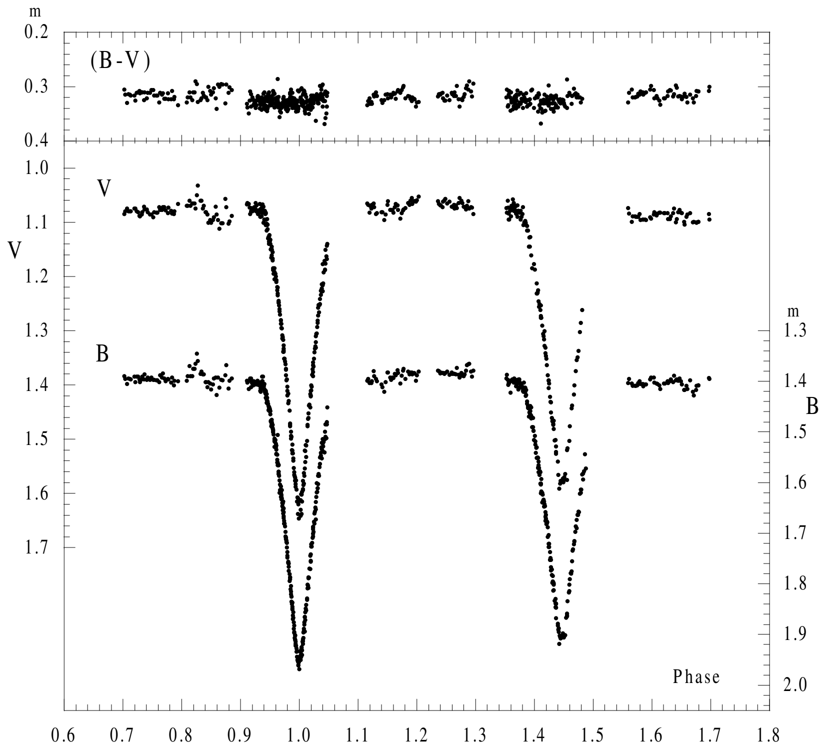

Figure 1. The light and color curves of DR Vul in 1993

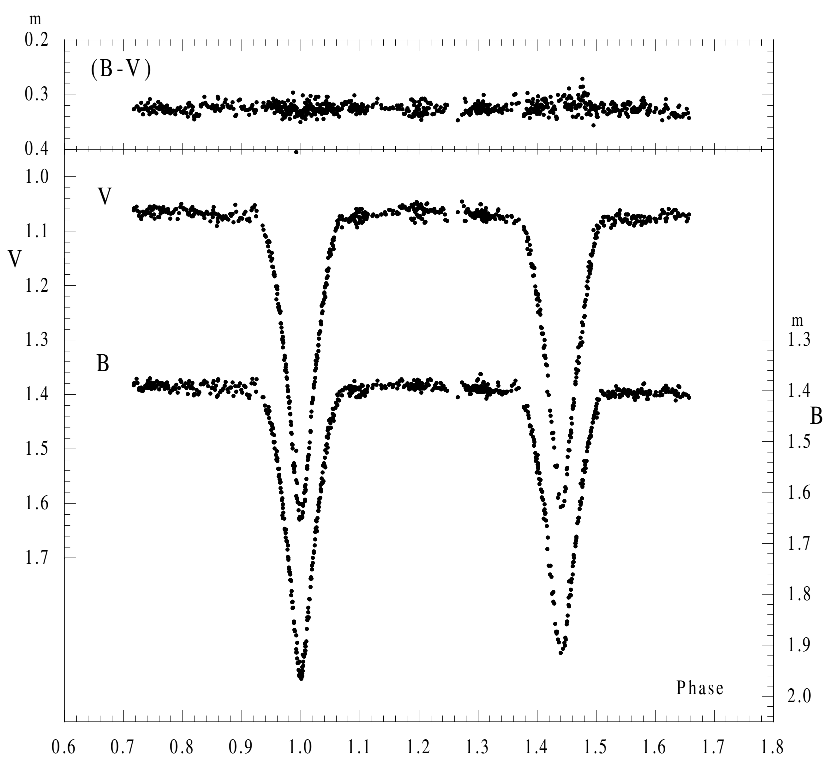

Figure 2. The light and color curves of DR Vul in 1994

Table 1: Photoelectric minima times of DR Vul, which are obtained in this work

JD Hel. 2400000 +	Filter	Min. Type	$O-C$	Observatory
49162.4627	B	I	0.0685	EUO
49163.4670	B	II	-0.0524	EUO
49180.4704	B	I	0.0718	EUO
49181.4774	B	II	-0.0465	EUO
49189.4755	B, V	I	0.0746	EUO
49198.4774	B, V	I	0.0743	EUO
49207.4816	B, V	I	0.0763	EUO
49208.4878	B, V	II	-0.0428	EUO
49216.4854	B, V	I	0.0779	EUO
49225.4893	B, V	I	0.0795	EUO
49574.3833	B, V	I	0.1372	EUO
49575.3788	B, V	II	0.0075	EUO
49592.3911	B, V	I	0.1406	EUO
49593.3869	B, V	II	0.0111	EUO
49601.3953	B, V	I	0.1425	EUO
49610.3998	B, V	I	0.1448	EUO
49611.3932	B, V	II	0.0129	EUO
51737.4606	B, V	I	0.4294	TNO
51738.3922	B, V	II	0.2357	TNO

Remarks:

DR Vul, which is a well-known eclipsing binary star with apsidal motion, was observed photoelectrically at the Ege University Observatory (EUO) on 40 nights during 1993 and 1994 observing seasons and at the TÜBİTAK (Scientific and Technical Research Council of Turkey) National Observatory (TNO) on 2 nights during 2000 observing season. During the observations no significant light variation of the comparison and check star was found. The atmospheric extinction coefficients in each color for each observational night were calculated from the observations of the comparison star using conventional method. Then, all the instrumental differential B and V magnitudes (in the sense variable minus comparison) were corrected for the atmospheric extinction and the light time effect of the Earth's motion. The instrumental differential B and V light and $B-V$ color curves are shown in Figures 1 and 2.

During the observations, I obtained 12 primary and 7 secondary times of minimum light. These times of the minima are presented in Table 1. The times of the minima given in Table 1 are averaged values of the eclipse times obtained in B and V colors during the same observational night. The $O-C$ values were calculated using the following light elements given by Çiçek (1995):

$$\mathrm{HJD}_{\mathrm{min\,I}} = 2449162.4631(2) + 2\overset{\mathrm{d}}{.}2509350(15) \times E.$$

The photometric phases in Figures 1 and 2 are calculated with the formula (1). The shape of the light curves of DR Vul is typical of EA type. As seen from the light curves, the phase of the mid-secondary minimum (0.447 in 1993 and 0.440 in 1994) is clearly shifted from 0.5, and no significant variation at minima in $B-V$ color curves was found.

Acknowledgements:

We would like to present our thanks to the Ege University Observatory and TÜBİTAK National Observatory for partial financial and equipment support.

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V, R & I LIGHT CURVES OF CONTACT BINARY SYSTEM AK Her

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AK Her is a W UMa type contact binary system, first detected by Pickering (1917). It is the brighter component of the visual binary ADS 10408, with the fainter component at a separation of 4.″7. Previously obtained light curves show the primary minima fainter than the secondary minima and Max II fainter than Max I (Bookmyer 1972). The secondary minima observed by Bookmyer were also seen to be slightly shifted from phase 0.5.

Many studies have gone into the period variations of AK Her. The system was previously seen to be showing a sinusoidal $O-C$ curve and thus a periodic variation of the orbital period. Bookmyer and Kaitchuck (1979) suggested the presence of an unseen additional component in the system. Rovithis-Livaniou et al. (1999) and Varricatt, Ashok & Chandrasekhar (1995) have reported the departure of the recent values of $O-C$ from the sinusoidal nature. In this paper, we present new epochs of primary and secondary minima and an analysis of the light curves of AK Her obtained by us in the V, R & I photometric bands.

AK Her was observed from the Mt. Abu Observatory, Rajastan, India during 1994 with a 14′ telescope and an HPC-1 Spectra Source CCD camera. Observations were done in the V, R & I bands using Johnson filters. BS 6337 was used as the comparison star. Fig. 1 shows the observed light curves in the three bands. We later noticed that BS 6337 is a variable (Percy & Fleming 1992). So part of the scatter in the light curve can be attributed to the comparison star. However, during the period of our observations, its variability would not have caused too big errors. Observations are taken over several orbital cycles covering many primary and secondary minima. The errors in the observed magnitudes are $0\overset{m}{.}03$ in the V band and $0\overset{m}{.}04$ the R & I bands. The observed light curves have light contribution from the visual companion. The system is slightly fainter around phase 0.75 than around phase 0.25 in all the three bands. The primary minima are deeper than the secondary minima and the secondary eclipse is total.

Times of minima are calculated by fitting a series of Legendre polynomials to the observations of the eclipse and applying a method similar to Kwee–van Woerden (Kwee & van Woerden 1956) to the fitted polynomial. Since, sometimes the observation of the light curve close to the minima were not very frequent, this was essential. Whenever there are observations of the same eclipse in different photometric bands, individually determined moments of minima are averaged to increase the accuracy of the determined epochs. 4 epochs of primary minima and 3 epochs of the secondary minima are obtained from our observations. The errors in the determined epochs are due to the inaccuracies in the photometry and the insufficient sampling of the light curve around regions of minima. The epochs determined and the values of $O-C$ are given in Table 1. The $O-C$s are evaluated using the ephemeris given by Woodward (1942):

$$\text{Min I} = 2422977.254 + 0\overset{\text{d}}{.}42152207 \times E.$$

The values of $O-C$ evaluated from our data depart significantly from the previously considered sinusoidal $O-C$ curve and are consistent with the increasing trend seen by Rovithis-Livaniou et al. (1999) from their data taken during the period 1985–87, and Tunca et al. (1987). The epochs of primary minima obtained by Albayrak, Müyesseroglu & Özdemir (2000) also show this increasing trend of the O-C values. Recent work by Li, Zhang & Han (2001) shows that the period variation of AK Her contains one component of long term decrease and three other components of periodic variations.

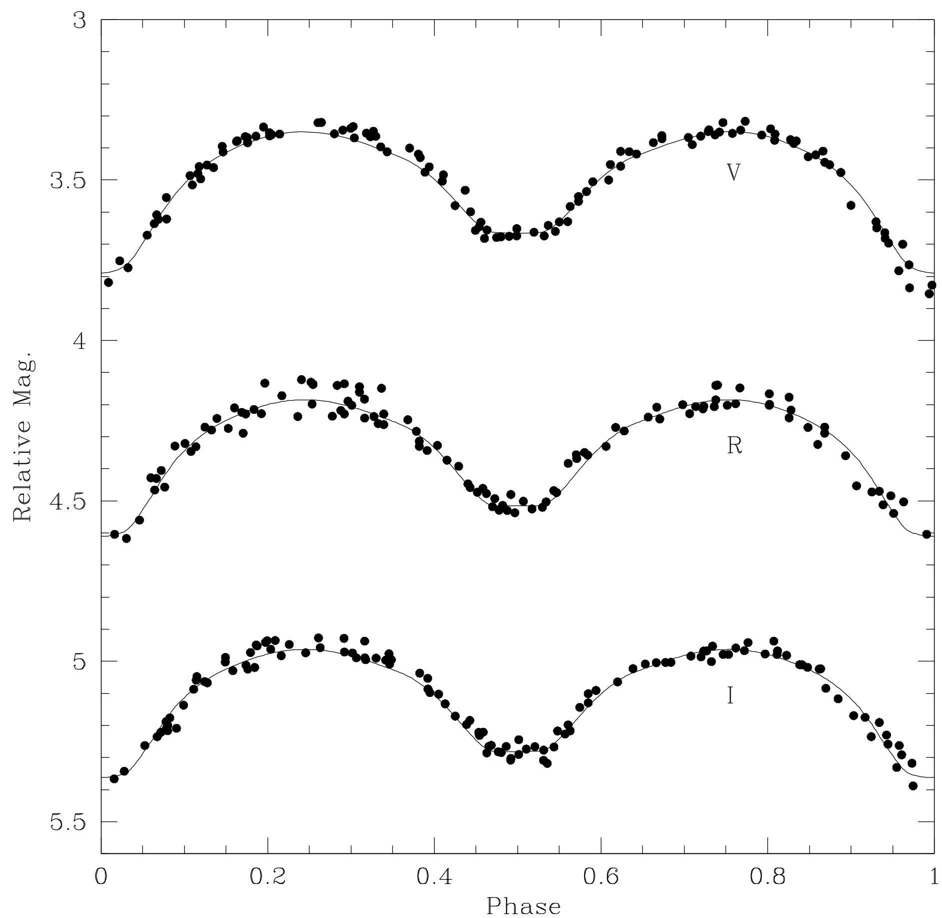

Figure 1. Filled circles show the observed points (AK Her – BS 6337). The model fit is shown by the continuous line

The observed light curves in the three bands, V, R & I are shown in Fig. 1. The observed points are normalized in phase bins of 0.014. V, R & I light curves are analyzed simultaneously using the Wilson–Devinney light curve interpretation program (Wilson & Devinney 1971, Wilson 1993). Due to the large noise in the light curves, we have not attempted a fit for all the parameters. The primary and the secondary temperatures (T_1 = 6400 K, T_2 = 6030 K), inclination ($i = 81\overset{\circ}{.}80$), mass ratio ($q = 0.2331$) and surface potential ($\Omega = 2.2980$) were fixed to the values given by Lucy & Wilson (1979).

Table 1: The times of minimum light of AK Her, derived from the present observations

Hel. JD 2440000 +	Min. Type	Epoch	$O-C$ (days)
9486.3778	I	62889	0.0223
9490.3894	II	62898.5	0.0295
9491.4403	I	62901	0.0266
9492.2806	I	62903	0.0238
9494.3923	I	62908	0.0279
9495.4460	II	62910.5	0.0278
9496.2906	II	62912.5	0.0294

Table 2: Elements obtained from the analysis of V, R & I light curves of AK Her. A superscript f implies that parameter was fixed during the analysis

Parameter	Photometric Bands Observed		
	V	R	I
r_2/r_1		0.519	
x_1^f	0.600	0.470	0.400
x_2^f	0.620	0.490	0.390
$x_{1,\mathrm{bol}}^f$		480	
$x_{2,\mathrm{bol}}^f$		495	
$L_1/(L_1+L_2)$	0.842 ± 0.002	0.828 ± 0.002	0.824 ± 0.002
$L_2/(L_1+L_2)$	0.158 ± 0.002	0.172 ± 0.002	0.176 ± 0.002
l_3	0.032 ± 0.001	0.032 ± 0.001	0.036 ± 0.001

Gravity darkening coefficient was taken to be 0.32. A linear law was adopted for the limb darkening and the values were adopted from Al Naimiy (1978) and Van Hamme (1993) for the monochromatic and bolometric limb darkening respectively. The adopted values of limb darkening coefficients (x) are shown in Table 2. The reflection albedo was fixed at 0.5. The light curves were fitted with L_1, L_2 & l_3 as free parameters. Table 2 gives the parameters evaluated in each band. Subscripts 1 & 2 refer to the primary and the secondary components. L_1 & L_2 derived by us are similar to those obtained by Rovithis-Livaniou et al. (2001). The value of l_3 shown is the third light normalized by the systemic light at phase 0.25. The visual companion is expected to be the main contributor to the third light.

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THE FIRST GROUND-BASED PHOTOMETRIC OBSERVATIONS OF GM DRACONIS

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Name of the object:
GM Dra = BD +58°1721 = HIP 84837 = HD 238677

Equatorial coordinates:	**Equinox:**
R.A.= $17^{\rm h}20^{\rm m}21\overset{\rm s}{.}89$ **DEC.=** $+57°58'26\overset{''}{.}92$	2000

Observatory and telescope:
TÜBİTAK (Scientific and Technical Research Council of Turkey) National Observatory, 40-cm Cassegrain telescope

Detector:	Hamamatsu, R 4457 (PMT)

Filter(s):	Johnson B, V and R

Comparison star(s):	BD +58°1716

Check star(s):	BD +58°1730

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	EW

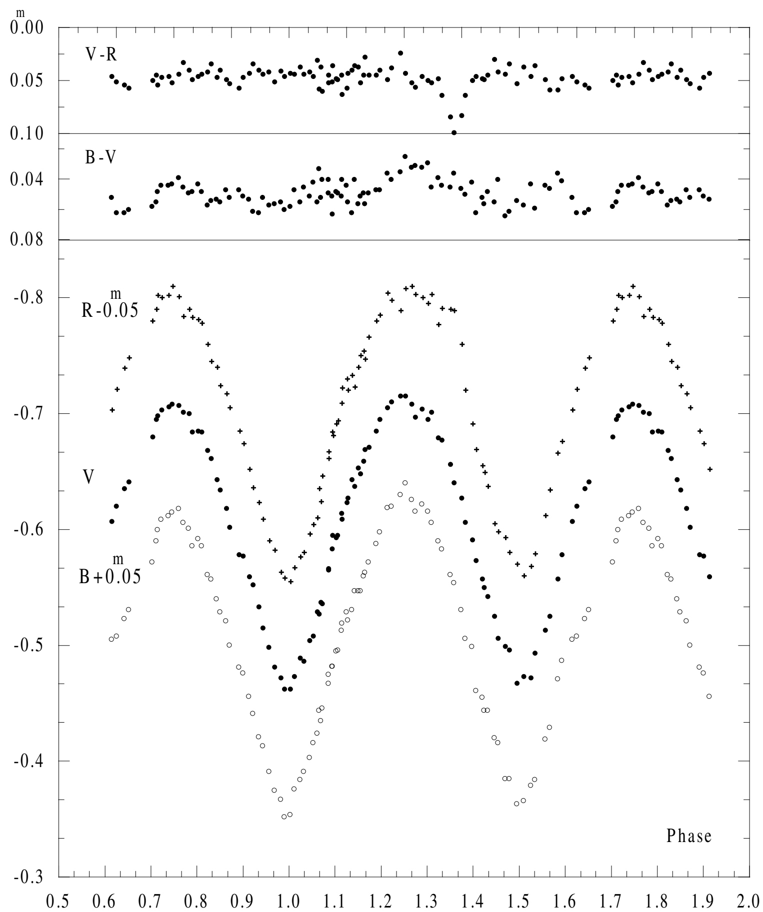

Figure 1. The light and color curves of GM Dra

Table 1: Photometric minima times of GM Dra

JD Hel. 2400000 +	Min Type	$O-C$	Reference
48500.1791	I	−0.0001	HIPPARCOS ESA (1998)
51743.4579(3)	II	0.0011	This work
51750.3999(7)	I	−0.0011	This work

Table 2: The light levels and their differences in the light curves of GM Dra

	B	V	R
Max. light at 0.75	−0.665	−0.708	−0.735
Max. light at 0.25	−0.685	−0.715	−0.743
Min. light at 0.00	−0.404	−0.462	−0.507
Min. light at 0.50	−0.413	−0.470	−0.510
Δmax. $(m_{0.75} - m_{0.25})$	0.020	0.007	0.008
Δmin. $(m_{0.00} - m_{0.50})$	0.009	0.008	0.003
Depth of Min. I	0.271	0.250	0.232
Depth of Min. II	0.262	0.242	0.229

Remarks:

The variability of GM Dra was first discovered by HIPPARCOS (ESA, 1998). The photometric observations of the system by HIPPARCOS show a β Lyrae type light curve with an amplitude of $0\overset{m}{.}27$ ranging from $8\overset{m}{.}77$ to $9\overset{m}{.}04$. The mean orbital period derived by HIPPARCOS from the best light curve fit is $0\overset{d}{.}338736$ and the epoch is given as HJD 2448500.1791 (ESA, 1998). The spectral type of the system is given as F8.

The first ground-based photometric observations of GM Dra were made on 3 nights during 2000 observing season. The instrumental differential B, V and R light and $B-V$ and $V-R$ color curves are shown in Figure 1. During the observations, we obtained one primary and one secondary times of minimum light. These times of minima and their errors, which were determined by using the method of Kwee & van Woerden (1956), are presented in Table 1. The times of the minima given in Table 1 are averaged values of the eclipse times obtained in B, V and R colors during the same observing night. We have combined the epoch derived by HIPPARCOS with our values in order to derive the new epoch and period of the system and calculated the following improved light elements by using the least squares method:

$$\mathrm{HJD}_{\min \mathrm{I}} = 2451750.4010(11) + 0\overset{d}{.}3387412(2) \times E.$$

The $O-C$ values in column 3 in Table 1 were calculated using the ephemeris given in this formula.

The photometric phases in Figure 1 were calculated with this formula. The shape of the light curves of GM Dra in Figure 1 is a typical of EW type, although it was noted to be EB type in HIPPARCOS (ESA, 1998). An asymmetry between the light level of maximum I (0.25 phase) and that of maximum II (0.75 phase), is clearly seen in the B light curve, but not seen in the V and R light curves (see Table 2). There are irregular variations in the $B-V$ and $V-R$ color curves in the Figure 1. Especially, there is a significant blueing at about 1.3 phase in the $B-V$ color curve and a significant reddening at about 1.38 phase in the $V-R$ color curve.

Acknowledgements:

We would like to present our thanks to the TÜBİTAK National Observatory for partial financial and equipment support. We also would like to present our thanks to the Research Fund of Çanakkale Onsekiz Mart University for partial financial support.

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PHOTOMETRIC OBSERVATIONS OF THE EXTREME MASS RATIO, HIGH CONTACT DWARF BINARY V902 SAGITTARII

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Ferwerda (1941, 1943) discovered V902 Sagittarii [V105, $a(2000) = 19^{\rm h}25^{\rm m}14^{\rm s}.155$, $d(2000) = -29^\circ09'08''.740$] in his study of faint variables near τ Sgr. An ephemeris ($P = 0^{\rm d}.2939444$), a finding chart, comparison stars and 28 times of minimum light are given in his paper. His photographic light curve gives evidence that V902 Sagittarii is a rare, high fill-out, small mass ratio, over contact binary. Ben (1943) suggested that V902 Sgr might be an RR Lyr type. Since this object appeared to be an interesting variable in need of further study, it was included as a target for our 1993 observing run at Cerro Tololo InterAmerican Observatory in Chile. Our present observations were taken with the 1.0-m Yale Reflector and a Ga-As PMT and standard filters on July 22-23, 1993, by RGS. Around 300 observations were taken in each pass band. Our I curves have higher scatter than the others. The comparison star (GSC 6888 991, RA(2000) = $19^{\rm h}24^{\rm m}33^{\rm s}.630$, DEC(2000) = $-29^\circ12'10''.30$) and the check star (GSC 6888 1052, RA(2000) = $19^{\rm h}24^{\rm m}36^{\rm s}.541$, DEC(2000) = $-29^\circ12'22''.06$) are shown in Figure 1 as COMP and CHK, with the variable, VAR. Kwee (1962), gave a photographic magnitude range of 14.4 to 14.78 for V902 Sgr.

Table 1: Time of Minimum Light, V902 Sagittarii

JD Hel. 2440000 +	Min	Cycles	$O-C$
9190.6293(2)	I	−3.5	−0.0018
9190.7797(15)	II	−3	0.0016
9191.6589(3)	I	0	−0.0010
9191.8081(10)	II	0.5	0.0011

Four mean epochs of minimum light were determined from two primary and secondary eclipses using the bisection of chords method. These precision epochs of minimum light are given in Table 1 along with their standard errors shown in parentheses. A linear ephemeris was calculated using our timings, Ferwerda's (1943) and one time from GCVS:

$$\text{J.D. Hel. Min I} = 2449191^{\rm d}.6599(84) + 0.29394574(17) \times E.$$

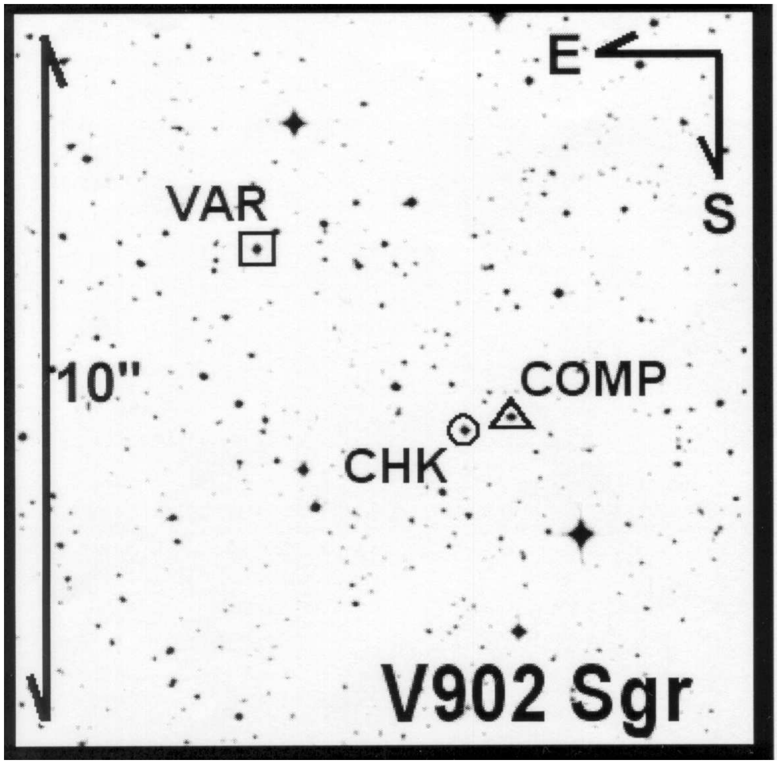

Figure 1. Finding chart of V902 Sgr, VAR, the comparison, COMP, and the check star, CHK

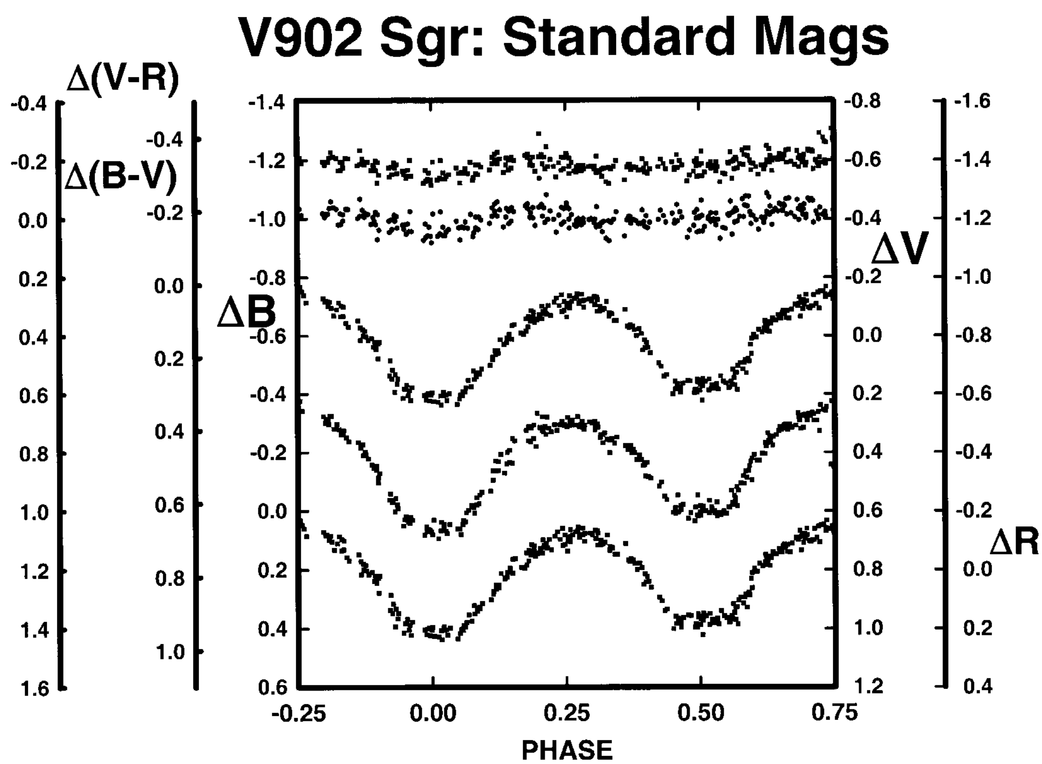

Figure 2. B, V, R standard magnitude light curves as defined by the individual observations

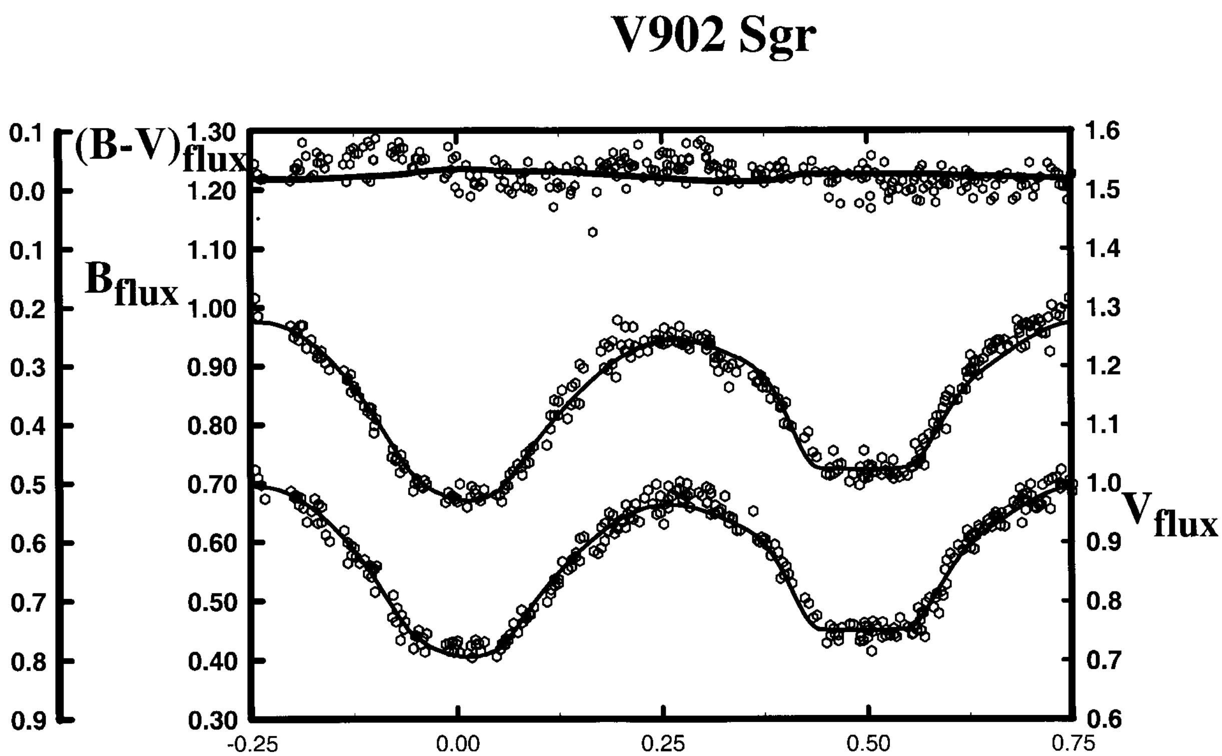

Figure 3. B, V, $B-V$ normalized flux light curves, and computed light curves for V902 Sgr

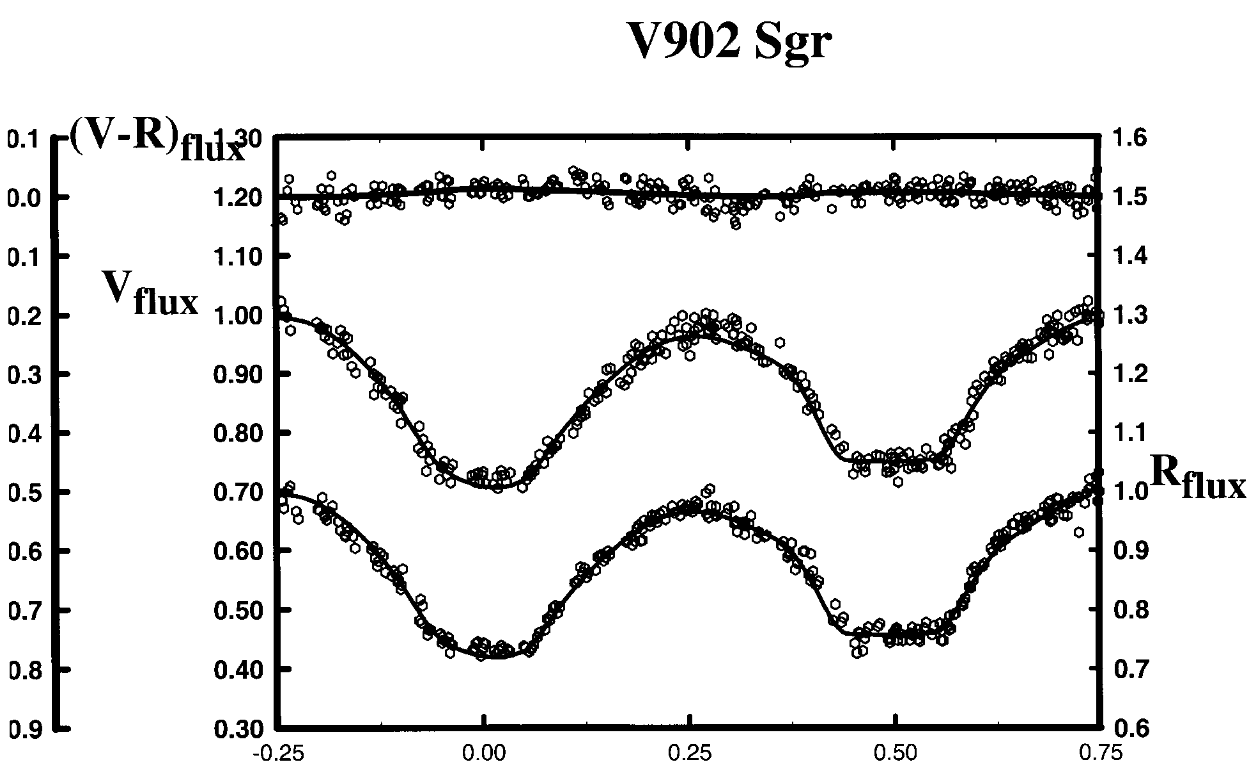

Figure 4. V, R, $V-R$ normalized flux light curves, and computed light curves for V902 Sgr

The standardized BVR_c magnitude light curves and the $B-V$ and the $V-R_c$ color curves of the variable are shown as Figure 2 as calculated from the differential magnitudes (VAR – COMP) versus phase. The probably errors of a single observation were $\sim 1\%$ in B, V, and R. The photometric spectral types of the dwarf comparison [$V = 13.95(2)$, $B-V = 0.85(2)$, $V-I_c = 0.88(3)$, $R_c - I_c = 0.41(2)$, $E(B-V) = 0.06$] and check stars [$V = 13.66(3)$, $B-V = 0.81(2)$, $V-I_c = 0.87(1)$, $R_c - I_c = 0.42(2)$] are K0 $\pm$ 0.3 and K0$\pm$1, respectively. The spectral type of the variable lies in the K4 to G4 range, averaging about G9V. The V magnitude range for the variable is 13.81(1)–14.18(2). These curves have been solved using the Wilson Code (Wilson 1994, 1990, Wilson & Devinney 1971). These yielded excellent fits to these asymmetric curves. The final parameters include $m_2/m_1 = 0.1199(3)$, fill-out 43(3)%, $T_2 - T_1 = 93(5)$ K. The curves were dominated by two spot regions, a hot spot on the secondary, less massive component, with a T factor of 1.186(6) and a radius of 30.8(6) degrees and a cool spot on the primary with a T factor of 0.927(1) and a radius of 28.0(2) degrees. The colatitudes were 129(1) and 104(1) degrees respectively. The solutions are shown in Figure 3 and 4 overlying the normalized flux curves. The early analysis of this binary was done as an undergraduate physics research project by SFC.

Acknowledgement. This research was partially supported by a grant from NASA administered by the American Astronomical Society.

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ERRATUM FOR IBVS 5145

In IBVS 5145 the reference to the paper "Ben, A.J., 1943, *AN*, **11**, No. 3" is erroneous. The correct reference is:

P. Guthnick, H. Schneller, 1944, *Astronomische Abhandlungen (Ergänzungshefte zu den Astronomischen Nachrichten)*, **11**, 3.

The Editors

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CCD LIGHT CURVES OF ROTSE1 VARIABLES, XI: GSC 2066:1210 Her, GSC 2063:902 Her, GSC 2594:1289 Her AND GSC 1522:599 Her

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VAR 1:

Name of the object:
GSC 2066:1210 = ROTSE1 J165039.99+274421.1

Equatorial coordinates:	**Equinox:**
R.A.= $16^h50^m40\overset{s}{.}0$ **DEC.=** $+27°44'21''$	2000.0

Comparison star(s):	GSC 2066:1252

Check star(s):	GSC 2066:1390

VAR 2:

Name of the object:
GSC 2063:902 = ROTSE1 J165551.74+245335.9

Equatorial coordinates:	**Equinox:**
R.A.= $16^h55^m51\overset{s}{.}7$ **DEC.=** $+24°53'36''$	2000.0

Comparison star(s):	GSC 2063:1158

Check star(s):	GSC 2063:992

VAR 3:

Name of the object:
GSC 2594:1289 = ROTSE1 J165819.76+334022.8

Equatorial coordinates:	**Equinox:**
R.A.= $16^h58^m19\overset{s}{.}8$ **DEC.=** $+33°40'23''$	2000.0

Comparison star(s):	GSC 2598:1627

Check star(s):	GSC 2594:1266

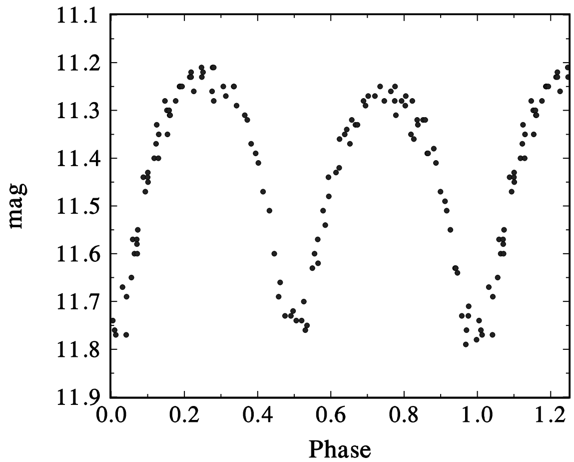

Figure 1. CCD light curve (without filter) of GSC 2066:1210

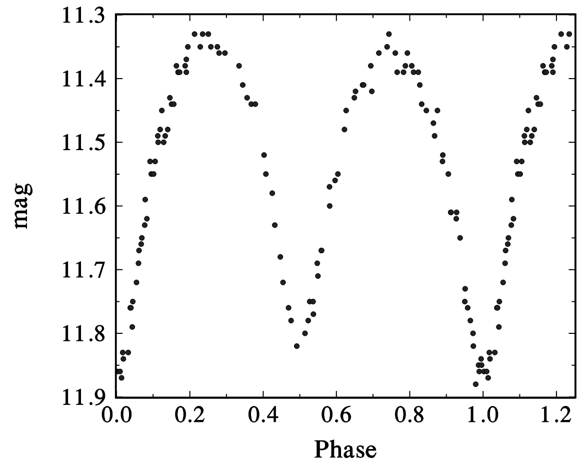

Figure 2. CCD light curve (without filter) of GSC 2063:902

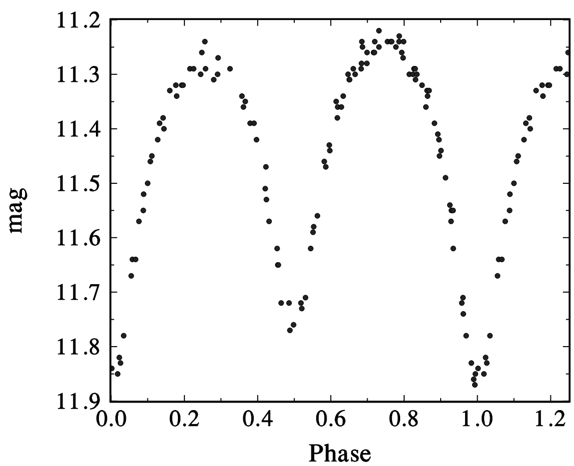

Figure 3. CCD light curve (without filter) of GSC 2594:1289

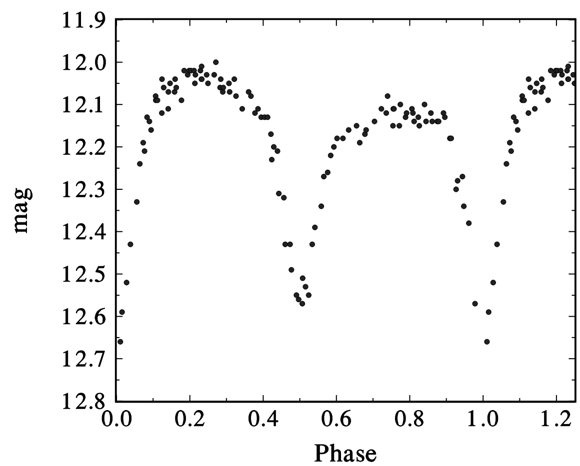

Figure 4. CCD light curve (without filter) of GSC 1522:599

VAR 4:

Name of the object:
GSC 1522:599 = ROTSE1 J165924.08+151220.7

Equatorial coordinates:	**Equinox:**
R.A.= $16^h59^m24\overset{s}{.}1$ **DEC.**= $+15°12'21''$	2000.0

Comparison star(s):	GSC 1522:351

Check star(s):	GSC 1522:1350

Observatory and telescope:
Private observatory Schüsselacher, Wald, 0.15-m Starfire refractor

Detector:	SBIG ST-7 CCD camera

Filter(s):	None

Availability of the data:
Upon request from diethelm@astro.unibas.ch

Type of variability:	E

Remarks:

As a byproduct of the ROTSE1 CCD survey, a large number of new variables have been discovered (Akerlof et al. 2000). In a series of papers, we report unfiltered CCD observations for some of the close binary systems (type E) in the list of Akerlof et al. (2000). This installment contains information on four variables in the constellation Hercules. The four stars were observed with our CCD equipment as mentioned above during 6 nights between JD 2452056 and JD 2452082. A total of 122 CCD frames were measured of GSC 2066:1210 (VAR 1), 119 frames of GSC 2063:902 (VAR 2), 121 frames of GSC 2594:1289 (VAR 3) and 116 frames for GSC 1522:599 (VAR 4). Figures 1–4 show our observations folded with the elements:

GSC 2066:1210: $\mathrm{JD(min,hel)} = 2452056.4147 + 0.298052 \times E$;
GSC 2063:902: $\mathrm{JD(min,hel)} = 2452073.3761 + 0.391676 \times E$;
GSC 2594:1289: $\mathrm{JD(min,hel)} = 2452056.4333 + 0.268179 \times E$;
GSC 1522:599: $\mathrm{JD(min,hel)} = 2452065.4890 + 0.507924 \times E$.

These elements of variation are deduced from a linear fit to the normal minima from the ROTSE1 data (Diethelm 2001) and the timings of minimum derived from our data given in Blättler (2001).
The light curve of GSC 1522:599 attracts attention through the marked difference in the brightness of the two shoulders between the minima as well as a possible variability of these brightnesses. In addition, the period should be checked because the number of revolutions between the ROTSE1 data and our new photometry is somewhat ambiguous.

Acknowledgements:

This research made use of the SIMBAD data base, operated at CDS, Strasbourg, France.

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BVRI OBSERVATIONS OF AH Her IN OUTBURST

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Dwarf Novae (DNe) are close binaries with mass transfer from a late-type main-sequence or slightly evolved secondary, to a white dwarf primary. Mass is transferred from the late-type star, through the inner Lagrangian point towards the white dwarf primary. This material forms an accretion disk around the primary. The main features of DNe are recurrent outbursts: unpredictable rises of luminosity, about 2–6 mag, with a recurrence time-scale from tens to hundreds of days and with duration of about a week. The dwarf novae may be subdivided into U Gem stars (normal light curves), SU UMa stars (presence of superhumps and superoutbursts) and Z Cam stars (presence of standstills in the light curve). AH Her is a DN of Z Cam subtype: during the decline, after the maximum, it shows occasionally periods of standstill during which the brightness is approximately constant. AH Her varies in magnitude from $V = 14.3$ in quiescence to $V = 11.3$ during outbursts, that last 4–18 days and recur at intervals of 7–27 days (Ritter & Kolb 1998). The colour index $B-V$ varies from 0.04 to 0.13 in the maximum of an outburst, while in the minimum $B-V$ varies from 0.24 to 0.55 (Bruch 1984). Williams (1983) reported a spectroscopic study of the star: he published a spectrum of the variable at minimum and he gave the equivalent width of some lines of the Balmer series. Moffat & Shara (1984) determined from photometric observations an orbital period of $0^{\rm d}.247$. Previously Wargau et al. (1983) have suggested that AH Her has an orbital period of 5.9 ± 0.5 hours, based on the rate of decline after outbursts. Horne et al. (1986) made spectroscopic observations and determined an orbital period of $0^{\rm d}.258116$. They found a mass ratio $M_2/M_1 = 0.80$ with $M_1 = 0.95M_\odot$ and $M_2 = 0.76M_\odot$; the calculated inclination of the orbital plane is $i = 46^\circ$, with a secondary of the K spectral type.

We observed this Dwarf Nova intermittently at the Astronomical Observatory of the Perugia University from 28/06/1997 to 04/10/1997, for a total of 31 observational nights. The instruments used and the photometric techniques have been already described in Spogli et al. (1998). We used the calibration stars reported in Misselt (1996) with the numbers 1, 2, 3. Moreover we calibrated these comparison stars with the I_c filter by observing, on photometric nights, several standard stars (Landolt 1992) having $B-V$ from -0.2 to 1.4, over a wide range of airmass. The weighted means of the values obtained are: $I_c(1) = 12.07 \pm 0.03$, $I_c(2) = 14.22 \pm 0.05$, $I_c(3) = 13.40 \pm 0.04$.

The results presented here are part of a project devoted to gain multi-band light curves of a sample of DNe, with the goal of increasing the historical database and information on this class of variable sources which can help to constrain theoretical models. Table 1 shows

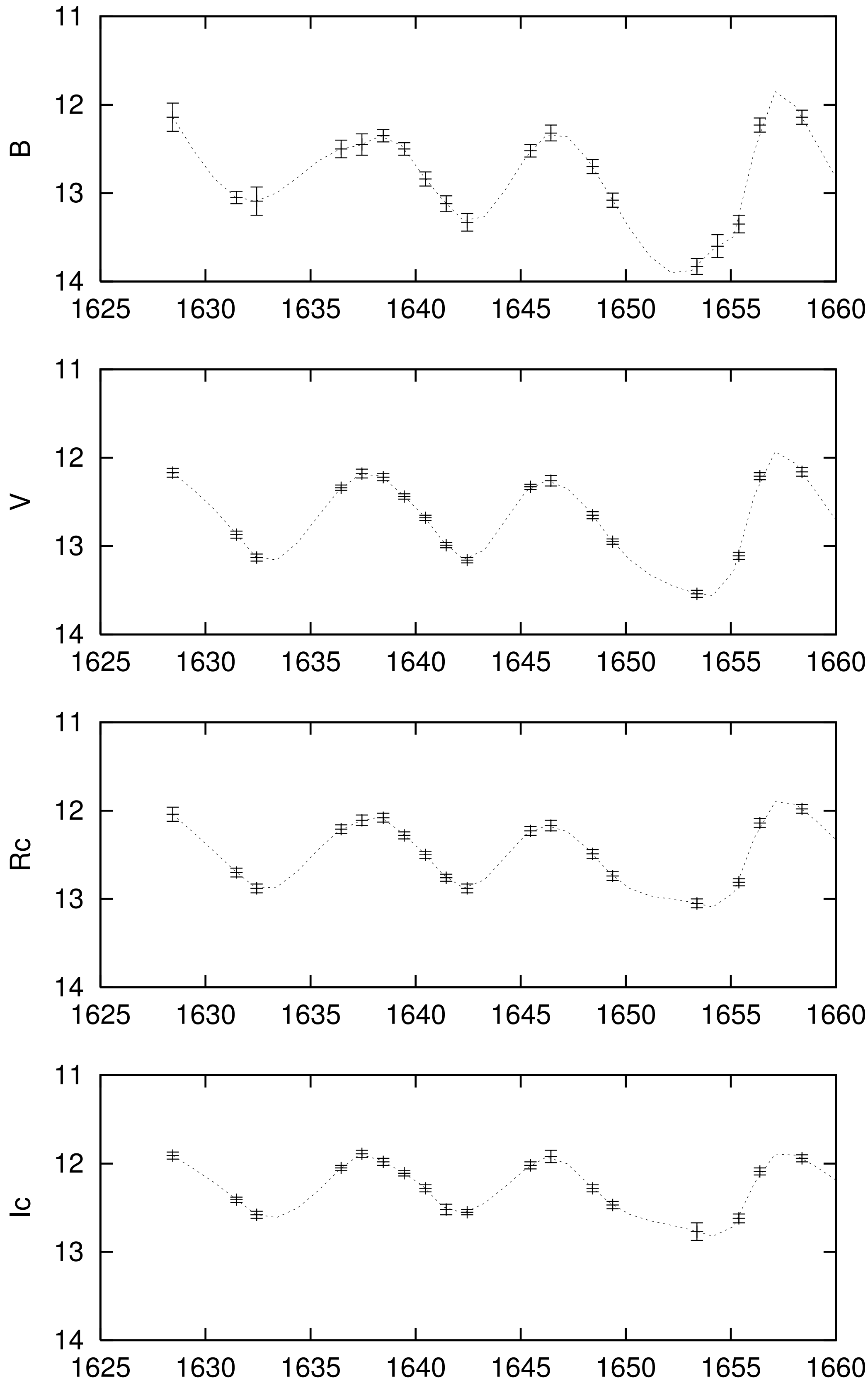

Figure 1. BVR_cI_c light curves of AH Her from 28/06/1997 to 26/07/1997. The numbers reported in the abscissa are the Julian Days starting from 2449000. The dotted lines connect consecutive points by natural cubic splines after rendering the data monotonic

the main characteristics of the light curves, while all the photometric data are reported in Table 2. In the first part of the light curve we can see quite symmetric low-amplitude oscillations (see Fig. 1), followed by more pronounced outbursts in the final part of our observations, after JD 2450658 (see Table 2).

Table 1

	B	V	R_c	I_c
Maximum Outburst	11.78 ± 0.07	11.81 ± 0.03	11.72 ± 0.03	11.61 ± 0.02
Minimum of Light	14.60 ± 0.10	14.06 ± 0.04	13.72 ± 0.04	13.19 ± 0.04
Mean Values at Minimum	14.1 ± 0.3	13.8 ± 0.3	13.4 ± 0.2	13.0 ± 0.2
Outburst Amplitude	2.8	2.1	2.0	1.6
	$B-V$	$V-R_c$	$V-I_c$	
Mean values at Maximum	0.06	0.12	0.25	
Mean Values at Minimum	0.33	0.42	0.85	

Figure 2 shows the colour–magnitude diagram for AH Her: obviously it is bluer during the outburst and redder in quiescence, but it is worth to note that the data seem to be well represented by a linear regression, and there is not a loop typical of other DNe (see, for example, Spogli et al. 2000a,b). This evidence, together with the symmetric light curve with comparable rise and decline times, may be in agreement with the inside-out model of the outburst described by Cannizzo & Kenyon (1987). However, for a conclusive sentence more precise observations are required, especially in the B band where the contamination of the secondary star is less important.

To study the behaviour of the optical continuum of the DN during the various outbursts, we converted the BVR_cI_c magnitudes in fluxes using the same procedure described in Spogli et al. (1998). We corrected the interstellar reddening adopting $A_V = 3.1$ and $E_{B-V} = 0.03$ (Bruch 1984). The spectral flux distribution of AH Her, during the several outbursts, is well described by a power law ($F(\nu) \propto \nu^{\alpha}$) with the slope α that varies from $\alpha = 0.3$ to $\alpha = 0.7$, while during quiescence the emission is dominated by the secondary star.

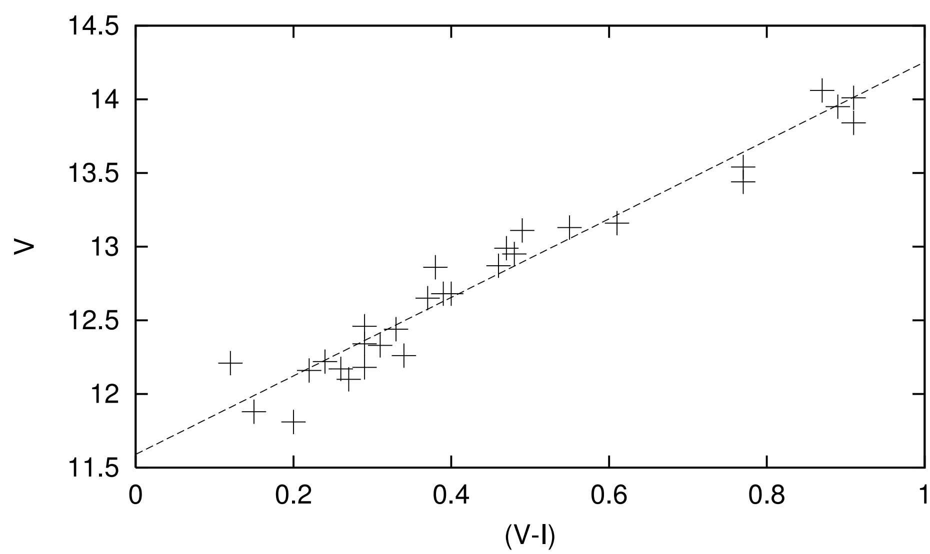

Figure 2. Colour index variation in the light curve. The dashed line shows the linear fitting

Table 2

JD (2449000 +)	B	V	R_c	I_c
1628.4448	12.20 ± 0.10	12.17 ± 0.05	12.04 ± 0.08	11.91 ± 0.04
1631.4781	13.05 ± 0.07	12.87 ± 0.04	12.70 ± 0.05	12.41 ± 0.03
1632.4342	13.09 ± 0.16	13.13 ± 0.04	12.88 ± 0.05	12.58 ± 0.04
1636.4552	12.50 ± 0.10	12.34 ± 0.03	12.21 ± 0.05	12.05 ± 0.03
1637.4438	12.45 ± 0.10	12.18 ± 0.05	12.11 ± 0.06	11.89 ± 0.04
1638.4592	12.35 ± 0.07	12.22 ± 0.04	12.08 ± 0.05	11.98 ± 0.04
1639.4631	12.50 ± 0.07	12.44 ± 0.03	12.28 ± 0.04	12.11 ± 0.03
1640.4631	12.84 ± 0.08	12.68 ± 0.03	12.50 ± 0.04	12.28 ± 0.04
1641.4557	13.12 ± 0.09	12.99 ± 0.03	12.76 ± 0.04	12.52 ± 0.06
1642.4545	13.33 ± 0.10	13.16 ± 0.03	12.88 ± 0.05	12.55 ± 0.03
1645.4701	12.50 ± 0.07	12.33 ± 0.03	12.23 ± 0.05	12.02 ± 0.04
1646.4325	12.32 ± 0.09	12.26 ± 0.06	12.17 ± 0.06	11.96 ± 0.06
1648.4199	12.70 ± 0.08	12.65 ± 0.04	12.49 ± 0.05	12.28 ± 0.04
1649.3727	13.08 ± 0.08	12.95 ± 0.03	12.74 ± 0.05	12.47 ± 0.04
1653.3877	13.83 ± 0.09	13.54 ± 0.04	13.05 ± 0.05	12.77 ± 0.07
1654.3621	13.60 ± 0.13			
1655.3806	13.35 ± 0.10	13.11 ± 0.04	12.81 ± 0.04	12.62 ± 0.05
1656.3796	12.23 ± 0.08	12.21 ± 0.04	12.14 ± 0.05	12.09 ± 0.04
1658.3826	12.14 ± 0.08	12.16 ± 0.05	11.98 ± 0.05	11.94 ± 0.04
1668.3495	14.13 ± 0.14	13.84 ± 0.04	13.38 ± 0.04	12.93 ± 0.04
1673.3448	12.52 ± 0.07	12.46 ± 0.03	12.30 ± 0.05	12.17 ± 0.04
1675.3425	12.99 ± 0.07	12.86 ± 0.03	12.67 ± 0.04	12.48 ± 0.03
1681.3215	14.60 ± 0.10	14.06 ± 0.04	13.72 ± 0.04	13.19 ± 0.04
1683.3186	14.31 ± 0.10	13.95 ± 0.04	13.54 ± 0.04	13.06 ± 0.04
1686.4093	11.81 ± 0.14	11.88 ± 0.04	11.72 ± 0.05	11.73 ± 0.06
1690.3251	11.78 ± 0.07	11.81 ± 0.03	11.77 ± 0.04	11.61 ± 0.02
1709.3043	13.66 ± 0.09	13.44 ± 0.04	13.08 ± 0.04	12.67 ± 0.03
1710.3026	14.27 ± 0.11	14.01 ± 0.04	13.53 ± 0.04	13.10 ± 0.03
1714.2986		13.71 ± 0.04	13.33 ± 0.05	
1716.2952	12.03 ± 0.07	12.10 ± 0.03	11.95 ± 0.04	11.83 ± 0.03
1726.2805	12.87 ± 0.08	12.68 ± 0.03	12.52 ± 0.04	12.29 ± 0.03

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Ritter, H., Kolb, U., 1998, *A&AS*, **129**, 83
Spogli, C., Fiorucci, M., Tosti, G., 1998, *A&AS*, **130**, 485
Spogli, C., Fiorucci, M., Raimondo, G., 2000a, *IBVS*, No. 4977
Spogli, C., Fiorucci, M., Raimondo, G., 2000b, *IBVS*, No. 4978
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COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 5148

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HU ISSN 0374 – 0676

GSC 5582.0545 IS AN ECLIPSING BINARY OF W UMa TYPE

(BAV MITTEILUNGEN NO. 137)

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[3] Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D–12169 Berlin, Germany

Name of the object:
GSC 5582.0545

Equatorial coordinates:	**Equinox:**
R.A.= $14^h51^m17\overset{s}{.}1$ **DEC.=** $-11°09'43''$	2000

Observatory and telescope:
P. Frank: Private observatory, 30-cm flat-field camera; K. Bernhard: Private observatory, 20-cm Schmidt–Cassegrain telescope

Detector:	P. Frank: OES-LcCCD11 camera; K. Bernhard: Starlight Xpress SX camera

Filter(s):	None

Comparison star(s):	GSC 5582.0574, $V \approx 11\overset{m}{.}6$

Check star(s):	GSC 5586.0018

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	W UMa

Remarks:

In 1998 the variability of GSC 5582.0545 has been found as part of a program to discover and classify new variables using CCD observations of selected fields on the edge of the northern Milky Way (eg. Bernhard & Lloyd 2000). Additional observations were performed on 7 nights between April and May 2000 (P. Frank). This star has previously been referred to as Brh V3 (Bernhard 1998, Moschner 2001).

The following times of minima were observed:

Type	JD Hel.
Min II	2451678.383
Min I	2451679.424
Min II	2451680.467

The ephemeris was calculated using the "Phase Dispersion Minimization" method:

$$\mathrm{MinI} = \mathrm{HJD}\ \underset{\pm 2}{2451679.424} + \underset{\pm 3}{0\overset{\mathrm{d}}{.}69552} \times E. \tag{1}$$

Acknowledgements:

This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France. The authors thank Dr. P. Kroll for helpful comments.

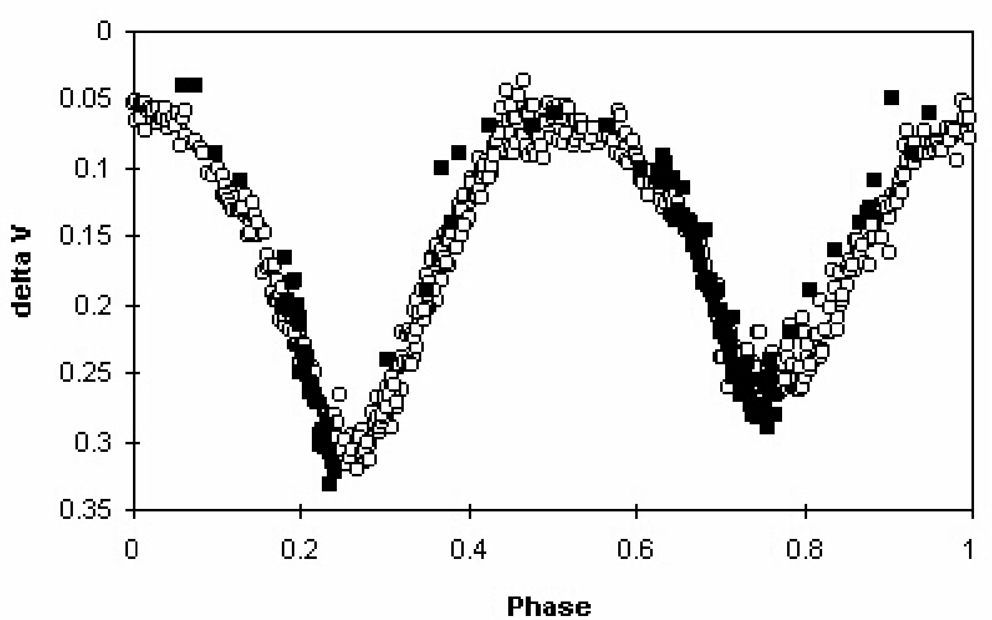

Figure 1. Differential light curve of GSC 5582.0545; filled squares: K. Bernhard, open circles: P. Frank

References:

Bernhard, K., 1998, *vsnet-obs*, No. 15317,
http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/obs15000/msg00317.html

Bernhard, K., Lloyd. C., 2000, *IBVS*, No. 4920

Moschner, W., 2001, http://www.var-mo.de/bev.sterne.htm

COMMISSIONS 27 AND 42 OF THE IAU
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Number 5149

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Budapest
26 July 2001

HU ISSN 0374 – 0676

THE LIGHT ELEMENTS AND A PRELIMINARY PHOTOMETRIC SOLUTION FOR THE BINARY GSC 2530-488

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TUCK, NATHAN[2]

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Recently Blättler and Diethelm (2001) published the unfiltered light curve of the 13th magnitude eclipsing binary GSC 2530-488. To confirm and improve the light elements and to provide a preliminary solution to filtered light curves, we recorded 96 R images and 125 V images of the star using the Air Force Academy 61-cm reflector with a 512×512, Photometrics, liquid nitrogen-cooled CCD camera. After flat fielding all the images, we used IRAF aperture photometry to extract magnitudes of the variable and two nearby field stars. The stars are identified in Figure 1.

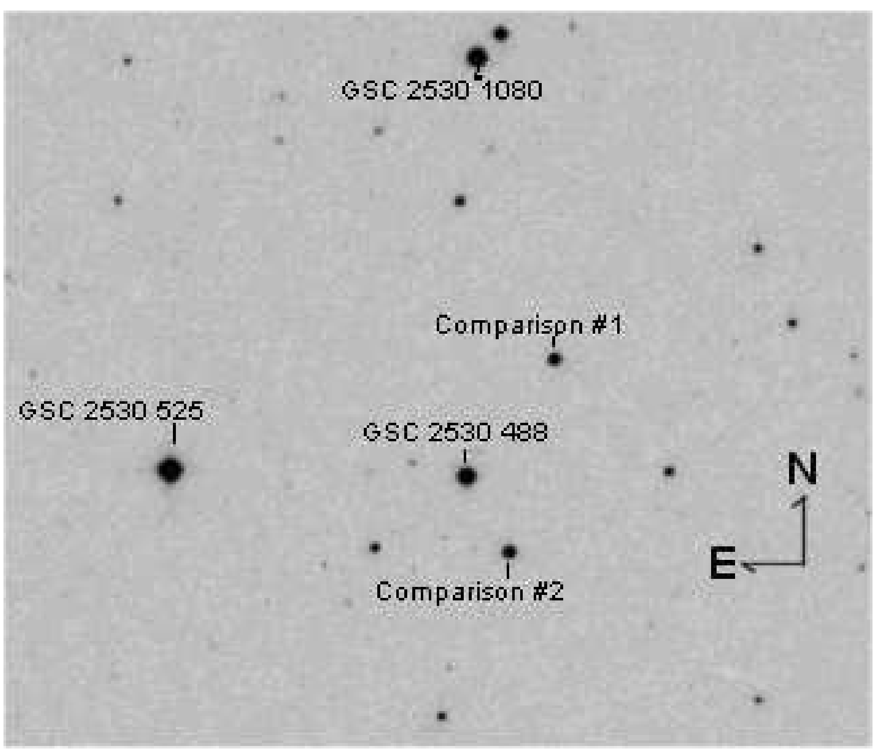

Figure 1. Finder chart for GSC 2530-488

To check on the photometric stability of the comparison stars, we computed the standard deviations of difference between the two stars. In V, for 125 differences on six nights, the standard deviation was $0\overset{m}{.}035$, and in R, for 96 differences on five nights, the standard deviation was $0\overset{m}{.}024$. Based on our observations we believe that these two stars are suitable comparison stars, and they were combined (by adding their luminosities) into a "super-comparison star" for the purposes of differential photometry with the variable.

We were able to find four new times of minimum light shown in Table 1.

Table 1: Times of minimum light

Source	HJD	Epoch	$O-C$	Filter
Akerlof et al.	2451244.6766	−2190	0.0031	Clear
Akerlof et al.	2451246.6826	−2184.5	−0.0028	Clear
BBSAG	2451951.4176	−258	0.0038	Clear
BBSAG	2451951.5965	−257.5	−0.0002	Clear
BBSAG	2451955.4379	−247	0.0002	Clear
BBSAG	2451959.4522	−236	−0.0094	Clear
BBSAG	2451967.3280	−214.5	0.0015	Clear
BBSAG	2451967.5094	−214	0.0000	Clear
BBSAG	2451984.5213	−167.5	0.0019	Clear
Present	2452045.7926	0	0.0004	R and V
Present	2452052.7426	19	0.0001	R
Present	2452053.8398	22	−0.0002	R
Present	2452054.7561	24.5	0.0016	R and V

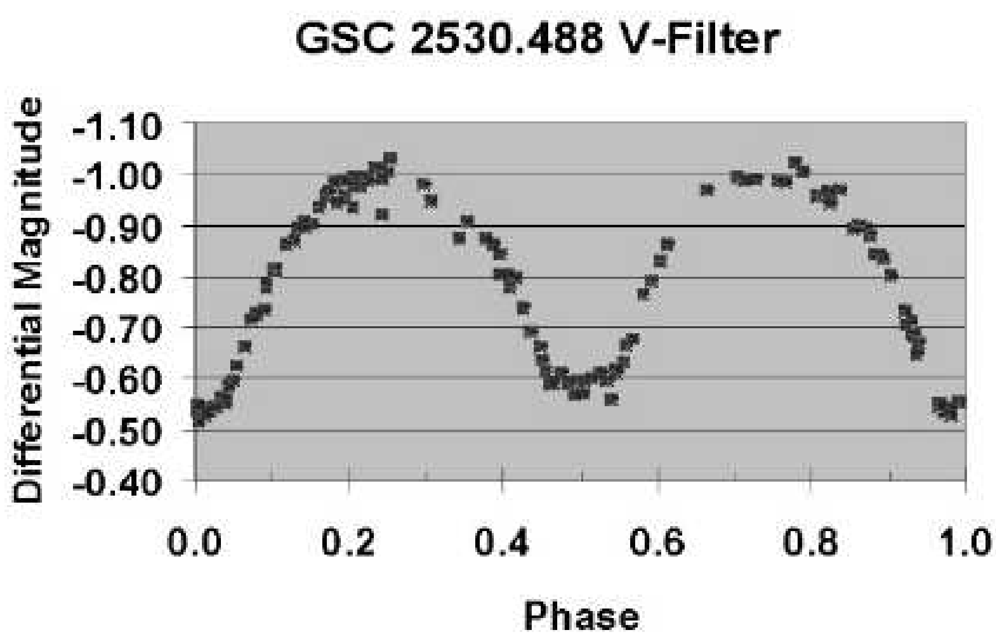

Figure 2. V light curve

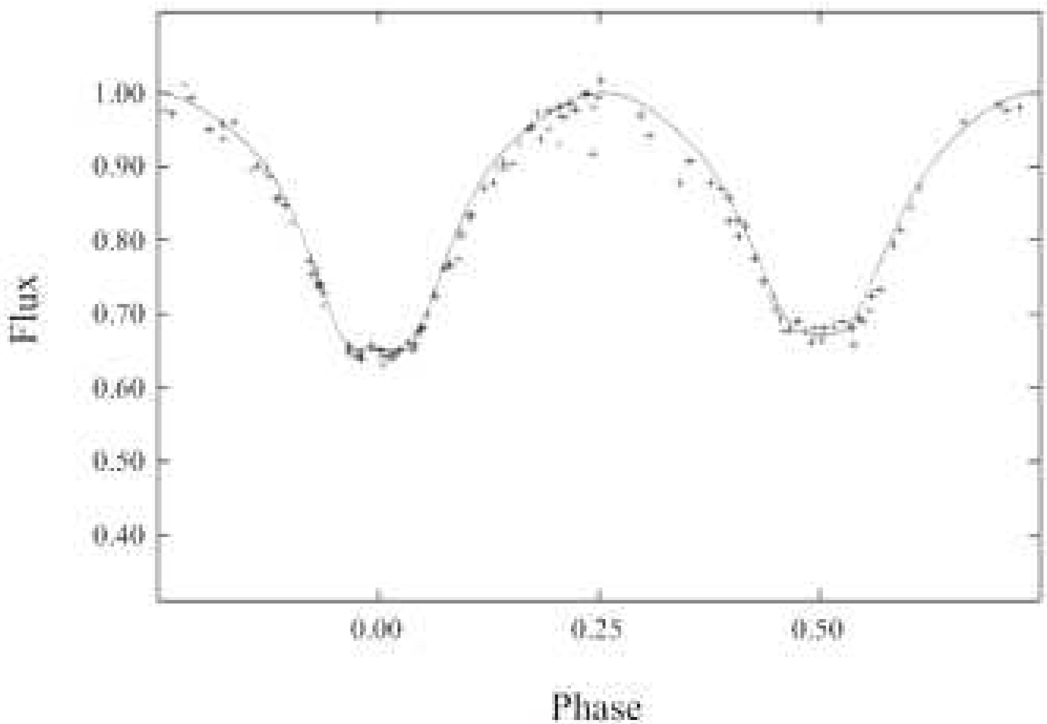

Figure 3. V intensity curve and fit

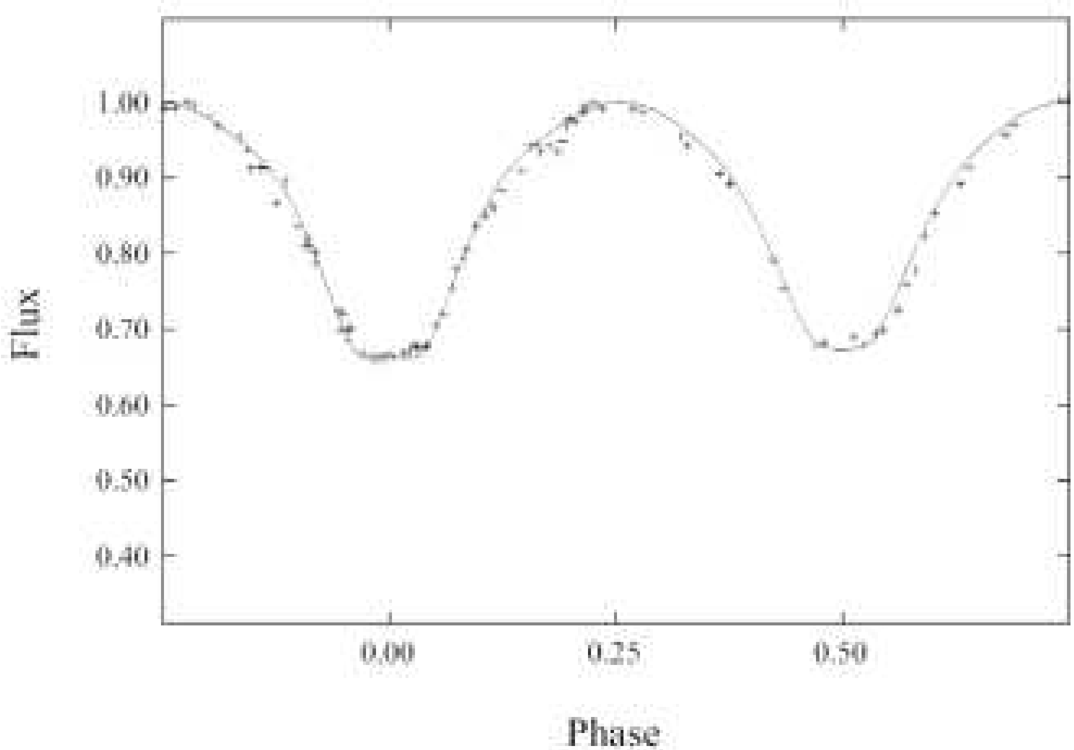

Figure 4. R intensity curve and fit

We found the new times using a tracing-paper method. The obvious asymmetry in the bottom of the R primary eclipse was ignored for this purpose. With these thirteen times of minimum a linear least squares fit yields the following light elements:

$$\text{Min I} = \text{HJD } 2452045.7922 + 0.365808 \times E.$$
$$\pm 0.0011 \ \pm 0.000001$$

Based upon our light curves, we have redefined the primary and secondary eclipses. With our new elements we built light curves such as the V curve shown in Figure 2. We observe that this is indeed an eclipsing binary with W Ursa Majoris-type light variations and total eclipses. The primary eclipse in V, an occultation, has a depth of about $0\overset{\mathrm{m}}{.}47$ and the secondary eclipse, a transit, has a depth of $0\overset{\mathrm{m}}{.}40$. In R light the depths are $0\overset{\mathrm{m}}{.}45$ and $0\overset{\mathrm{m}}{.}42$ on our instrumental system.

We used *Binary Maker 2.0* by David Bradstreet (1993) to obtain preliminary solutions to the light curves. We were unable to locate a spectral type for this system. However, our best fits were achieved assuming the two stars had temperatures of 7100 K and 7200 K. We used the following minor parameters characteristic of radiative stars: albedo and reflection coefficients = 1.0 and limb darkening coefficients = 0.5. Our best fits, shown in Figures 3 and 4, indicate that the stars are just in contact with an orbital inclination of 82°, and a photometric mass ratio of 4.15. The primary eclipse is an occultation of the hotter and smaller star. This model produces total eclipses that are almost flat during the total phases.

Acknowledgements: We thank the Air Force Academy for generous telescope time and assistance with the observations, and the Appalachian College Association for their support of this research. We also thank the editor for useful comments. This research made use of the SIMBAD database, operated at CDS, Strasbourg, France.

References:

Akerlof et al., 2000, *AJ*, **119**, 1901
BBSAG Bulletin, No. 125
Blättler, E., Diethelm, R., 2001, *IBVS*, No. 5052
Bradstreet, D., 1993, *Binary Maker 2.0*, Contact Software

COMMISSIONS 27 AND 42 OF THE IAU
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V1178 Sco: A NOVA WITH EARLY STAGE OSCILLATIONS

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e-mail: aikow@po.harenet.ne.jp

V1178 Sco was originally discovered by K. Haseda as a possible nova (Haseda 2001). Yamaoka (2001) examined the DSS, and noted that the object brightened by more than 8 magnitude. One of the authors (M.F.) further obtained a spectrum (resolution 1 nm) on June 24 with a 28-cm telescope, and detected a very strong Hα (FWHM about 1300 $\mathrm{km\,s^{-1}}$) emission line and a weaker Hβ line (Figure 1, upper panel). These observations confirmed that V1178 Sco is indeed a classical nova. A higher quality spectrum was obtained on July 2.57 UT, which shows the weak presence of P Cyg-type profile both in Hα and Hβ lines (Figure 1, lower panel). The Fe II emission series are characteristic to the early stage of a Fe II-class nova.

Since the discovery alert, V1178 Sco has been intensively followed by a number of observers of the VSNET Collaboration (http://www.kusastro.kyoto-u.ac.jp/vsnet/). The resultant light curve, together with prediscovery observations by K. Haseda, K. Takamizawa and K. Kanatsu, showed a rapid decline by $0\overset{\mathrm{m}}{.}7$ between 2001 May 13 and May 16. The object rose again by $0\overset{\mathrm{m}}{.}7$ on May 25 within five days. The object further showed a rapid decline by $\sim 0\overset{\mathrm{m}}{.}8$ between June 23 and 24. Such rapid, large-amplitude fluctuations are rare among known classical novae, although similar oscillations during the nova "transition" stage are more frequently met (Bode and Evans 1989).

Among recent novae, V4361 Sgr = Nova Sgr 1996, showed a similar feature. Figure 2 shows the comparison of light curves between V1178 Sco and V4361 Sgr. The horizontal scale is 1.5 times different between these two objects, possibly suggesting that V1178 Sco may be evolving more rapidly. However, the exact scaling is uncertain because of the lack of early observations in V4361 Sgr. The lack of information of line widths of V4361 Sgr in the literature makes it difficult to make a comparison between the time-scales of evolution and expansion velocities. The amplitude of oscillations looks larger in V1178 Sco than in V4361 Sgr. Whether such a difference is a result of a different speed of evolution needs to be examined by future observations and theoretical modeling. The mean decline rate of V1178 Sco was 0.03 $\mathrm{mag\,d^{-1}}$, which suggests a nova of a moderate speed class. The strongest period of the nova oscillations is 21 d.

On the occasion of V4361 Sgr, the early stage light variation was not unfortunately recorded because of a substantial delay in spectroscopic confirmation and the announcement in IAUC, in spite of the early detection by Sakurai (Sakurai, private communication).

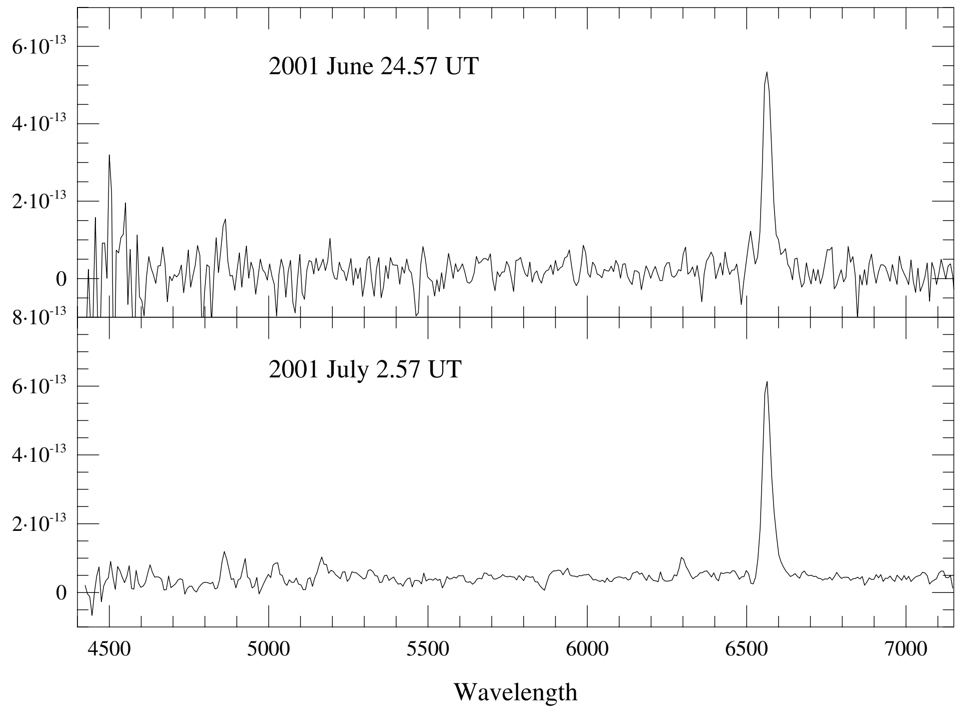

Figure 1. The spectra of V1178 Sco on June 24 and July 3. The spectra were taken with a 28-cm telescope at Fujii-Bisei Observatory. The unit in flux is erg s^{-1} cm^{-2} $Å^{-1}$, calibrated using a standard star HR 7950

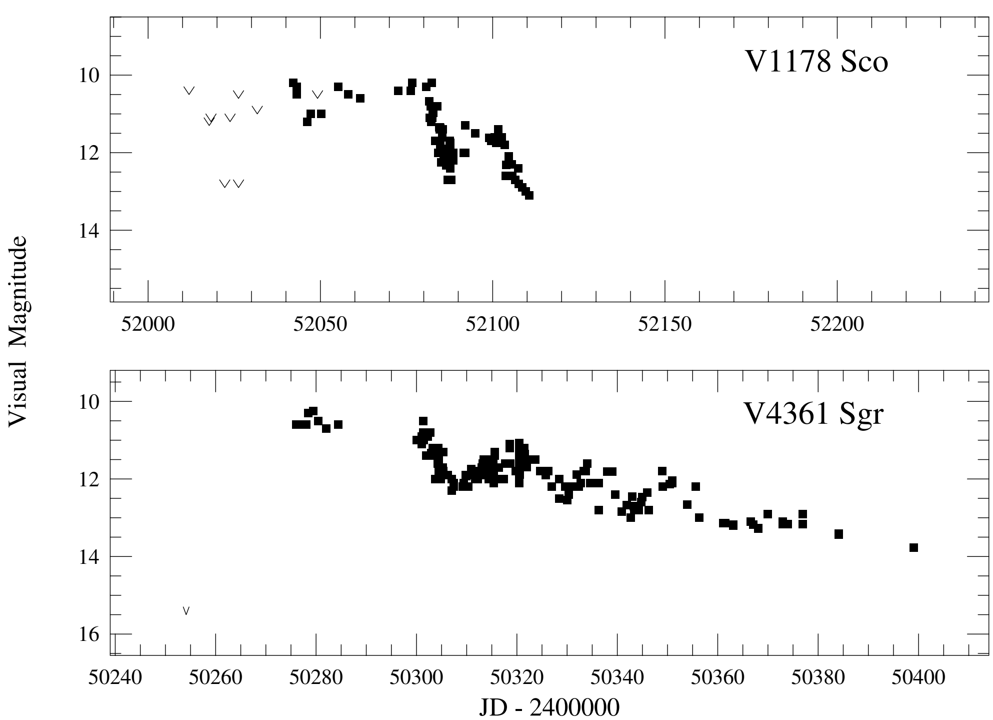

Figure 2. Comparison of light curves between V1178 Sco and V4361 Sgr. Visual, selected CCD observations (ones close to the V system), prediscovery photographic observations (either on photographic V system or on a system close to photovisual) are plotted. Photographic upper limits are marked with '$\vee$' symbols. The both light curves are drawn from reports to VSNET

V1178 Sco was fortunately covered by observations, and the present early announcement will provide an unprecedented opportunity to study such early stage oscillations of a nova in detail. Since V1178 Sco apparently belongs a rare class of classical novae with remarkable early phase oscillations, further observations are strongly encouraged.

The authors are grateful to VSNET members for providing vital observations of both novae.

References:

Bode, M. F., Evans, A., 1989, *Classical Novae* (Chichester Wiley)
Haseda, K., 2001, *IAUC*, No. 7647
Stellingwerf, R. F., 1978, *ApJ*, **224**, 953
Yamaoka, H., 2001, *IAUC*, No. 7647

COMMISSIONS 27 AND 42 OF THE IAU
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Number 5151

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HU ISSN 0374 – 0676

V608 CASSIOPEIAE: CCD LIGHT CURVE AND ELEMENTS OF VARIATION

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[2] BBSAG, Rennweg 1, CH-4118 Rodersdorf, Switzerland; e-mail: diethelm@astro.unibas.ch

Name of the object:
V608 Cassiopeiae

Equatorial coordinates:	**Equinox:**
R.A.= $02^h24^m15^s$ **DEC.**= $+71^\circ22'.7$	2000.0

Observatory and telescope:
Private observatory Schüsselacher, Wald, 0.15-m Starfire refractor

Detector:	SBIG ST-7 CCD camera

Filter(s):	None

Comparison star(s):	GSC 4319:1608

Check star(s):	GSC 4320:549

Availability of the data:
Upon request from diethelm@astro.unibas.ch

Type of variability:	EW

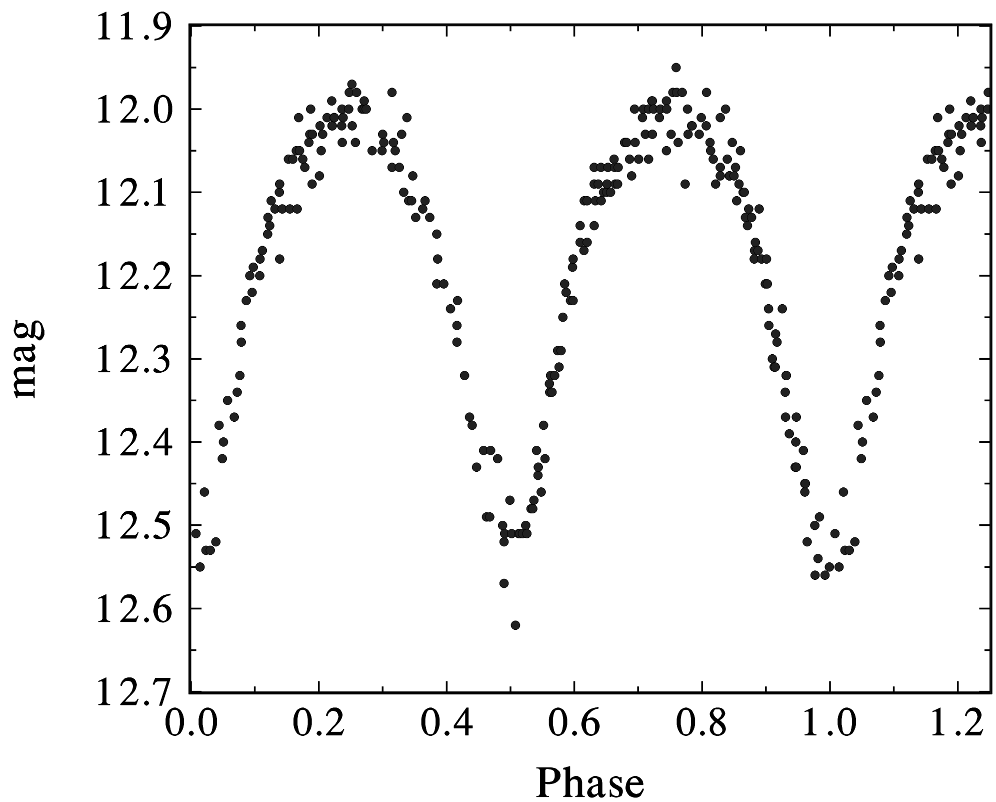

Figure 1. CCD light curve (without filter) of V608 Cassiopeiae

Remarks:

Hübel (1976) was the first to note the variability of the star V608 Cassiopeiae = GSC 4320:1035 = S 10797, which he discovered while studying the dwarf nova AM Cassiopeiae. He reported a possible eclipsing nature for the variation of the brightness with an amplitude of about 1 magnitude and a preliminary period of 0.47 days. According to the SIMBAD data base, no other source of information concerning the variability of V608 Cassiopeiae is available.

We have started an observing campaign with our CCD equipment in order to find more concrete information on the type and specifications of the variability. All the observations were secured by Blättler. He gathered a total of 261 measurements in eleven nights between JD 2451874 and JD 2452065. All CCD exposures were dark-subtracted and flat-fielded before aperture photometry was performed. No correction for differential extinction was applied due to the proximity of the comparison stars to the variable. We used GSC 4319:1608 (GSC-magnitude: 11.49) as primary comparison star, while GSC 4320:549, (13.17) served as check star, proving the constancy of the comparison star at the level of the accuracy of our photometry. In Figure 1, we show the results of our photometry, folded with the best elements obtainable from our data:

$$\begin{array}{ll}\text{Min. I} = \text{HJD } 2452041.5108 + & 0\overset{\text{d}}{.}380401 \times E. \\ \pm 0.0008 & \pm 0.000004\end{array}$$

The deduced times of minima are given in Table 1, and will be published in the next issue of the BBSAG Bulletin (Blättler 2001).

Table 1: Times of minima of V608 Cas

Time of minimum	Type
JD 2452041.5100(8)	I
JD 2452065.4768(9)	I
JD 2451926.4397(9)	II
JD 2452001.3790(8)	II
JD 2452058.4387(7)	II

Acknowledgements:
This research made use of the SIMBAD data base, operated at CDS, Strasbourg, France.

References:

Blättler, E., 2001, *BBSAG Bulletin*, **126**, in preparation
Hübel, B., 1976, *MVS*, **7**, 184

COMMISSIONS 27 AND 42 OF THE IAU
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Number 5152

Konkoly Observatory
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8 August 2001

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UBV PHOTOMETRY OF THE NEWLY FOUND ACTIVE STAR YY CORONAE BOREALIS

ERDEM, A.; BUDDING, E.; DEMİRCAN, O.; ÇİÇEK, C.; ÖZDEMİR, S.; BULUT, İ; SOYDUGAN, E.; SOYDUGAN, F.

Çanakkale Onsekiz Mart University, Faculty of Arts and Sciences, Department of Physics, TR-17100 Çanakkale, Turkey, aerdem@bornova.ege.edu.tr

Name of the object:
YY CrB = BD +38°2706 = HIP 77598 = HD 141990

Equatorial coordinates:	**Equinox:**
R.A.= $15^{\mathrm{h}}50^{\mathrm{m}}32^{\mathrm{s}}.43$ **DEC.=** $+37°50'07''.6$	2000

Observatory and telescope:
Ankara University Observatory, 30-cm Maksutov telescope

Detector:	Hamamatsu, R 1414 (PMT)

Filter(s):	Johnson U, B and V

Comparison star(s):	BD +38°2708

Check star(s):	BD +38°2701

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	EW

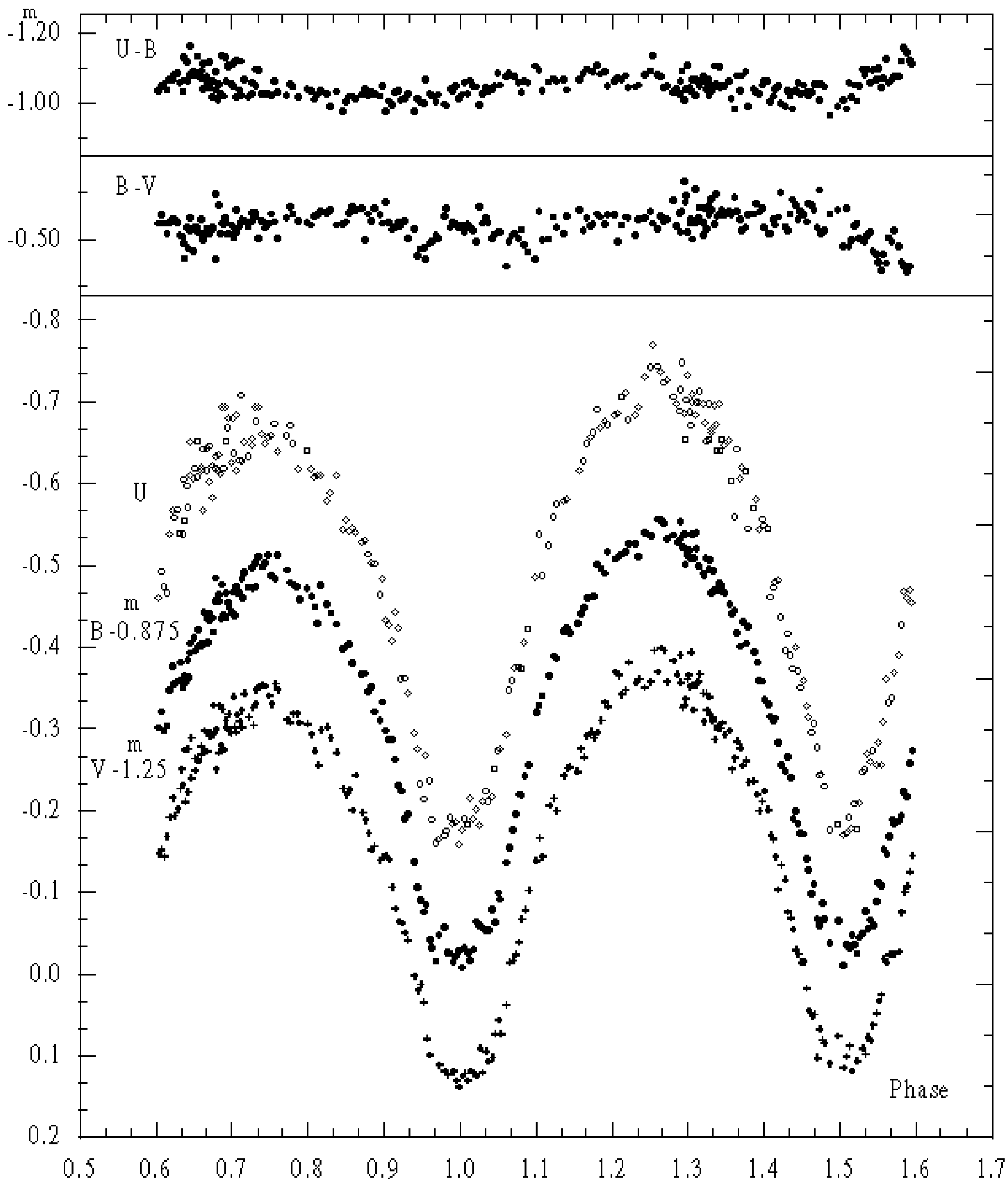

Figure 1. The light and color curves of YY CrB

Table 1: The light levels and their differences in the light curves of YY CrB

	U	B	V
Max. light at 0.75	−0.676	0.372	0.919
Max. light at 0.25	−0.736	0.324	0.867
Min. light at 0.00	−0.176	0.854	1.375
Min. light at 0.50	−0.177	0.840	1.352
Δmax. $(m_{0.75} - m_{0.25})$	0.060	0.048	0.052
Δmin. $(m_{0.00} - m_{0.50})$	0.001	0.014	0.023
Depth of Min. I	0.530	0.506	0.482
Depth of Min. II	0.529	0.492	0.459

Remarks:

The EW type active eclipsing binary star YY CrB was discovered by HIPPARCOS (ESA, 1997). The system has a spectral type of G5 and an amplitude of $0\overset{\mathrm{m}}{.}491$ ranging from $8\overset{\mathrm{m}}{.}643$ to $9\overset{\mathrm{m}}{.}134$ in V band (ESA, 1997). Sipahi et al. (2000) carried out the first ground based photometric observations of the system in B, V and R bands. Both the light curve of HIPPARCOS and light curves of Sipahi et al. have almost equal maxima and minima, and there are no significant asymmetries in their data. The star was observed photoelectrically with the 30-cm Maksutov telescope at the Ankara University Observation on the nights of 8 and 9 May, 2000. The phases of the observations were calculated using the following light elements given by Soydugan et al. (2000):

$$\mathrm{HJD}_{\mathrm{min\,I}} = 2448500.2535 + 0\overset{\mathrm{d}}{.}3765694 \times E.$$

The differential U, B and V light, and $U-B$ and $B-V$ color curves in the instrumental system are shown in Figure 1. The shape of the light curves are typical of W UMa type. A pronounced asymmetry is evident in the light curves. This asymmetry is located between the descending and ascending shoulders of the primary minimum (see Table 1). There is no significant variation due to maculation or proximity effects at either minimum in the $U-B$ and $B-V$ color curves in Figure 1.

Acknowledgements:

We acknowledge the observing time at the Ankara University Observatory. This work was supported by Çanakkale Onsekiz Mart University Research Fund (Project No. 99/FE/012).

References:

ESA, 1997, The Hipparcos & Tycho Catalogues, SP–1220
Sipahi, E., Keskin, V., Yaşarsoy, B., 2000, *IBVS*, No. 4859
Soydugan, F., Erdem, A., Özdemir, S., Demircan, O., Soydugan, E, Bulut, İ, 2000, in XII. National Astronomy Meeting, ed. İbanoğlu, C., Ege University Press, in press

COMMISSIONS 27 AND 42 OF THE IAU
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Number 5153

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Budapest
9 August 2001

HU ISSN 0374 – 0676

FIRST PHOTOMETRIC OBSERVATIONS OF MR DELPHINI

SOYDUGAN, F.[1]; BUDDING, E.[1]; DEMİRCAN, O.[1]; ERDEM, A.[1]; ÇİÇEK, C.[1]; ÖZDEMİR, S.[1]; BULUT, İ.[1]; SOYDUGAN, E.[1]; DEĞİRMENCİ, Ö.L.[2]; BOZKURT, Z.[2]; YAKUT, K.[2]; ESENOĞLU, H.[3]; HEGEDÜS, T.[4]; BORKOVITS, T.[4]; BÍRÓ, I.B.[4]

[1] Çanakkale Onsekiz Mart University, Faculty of Arts and Sciences, Department of Physics, TR-17100 Çanakkale, Turkey, sfaruk@astronomy.sci.ege.edu.tr, demircan@comu.edu.tr

[2] Ege University, Science Faculty, Department of Astronomy and Space Sciences, TR-35100 Bornova, Izmir, Turkey

[3] İstanbul University, Science Faculty, Deparment of Astronomy and Space Sciences, TR-34452 İstanbul, Turkey

[4] Baja Astronomical Observatory of Bács-Kiskun County, Baja, Szegedi út, P.O. Box 766, H-6500, Hungary

Name of the object:
MR Del = BD +04°4470 = HIP 101236 = HD 195434

Equatorial coordinates:	**Equinox:**
R.A.= $20^h31^m13\overset{s}{.}29$ **DEC.=** $+05°13'06\overset{''}{.}1$	2000

Observatory and telescope:
TÜBİTAK (Scientific and Technical Research Council of Turkey) National Observatory, 40-cm Cassegrain telescope

Detector:	Hamamatsu, R 4457 (PMT)

Filter(s):	Johnson B, V and R

Comparison star(s):	BD +04°4463 = HD 195235

Check star(s):	BD +04°4476 = PPM 170209

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	EA

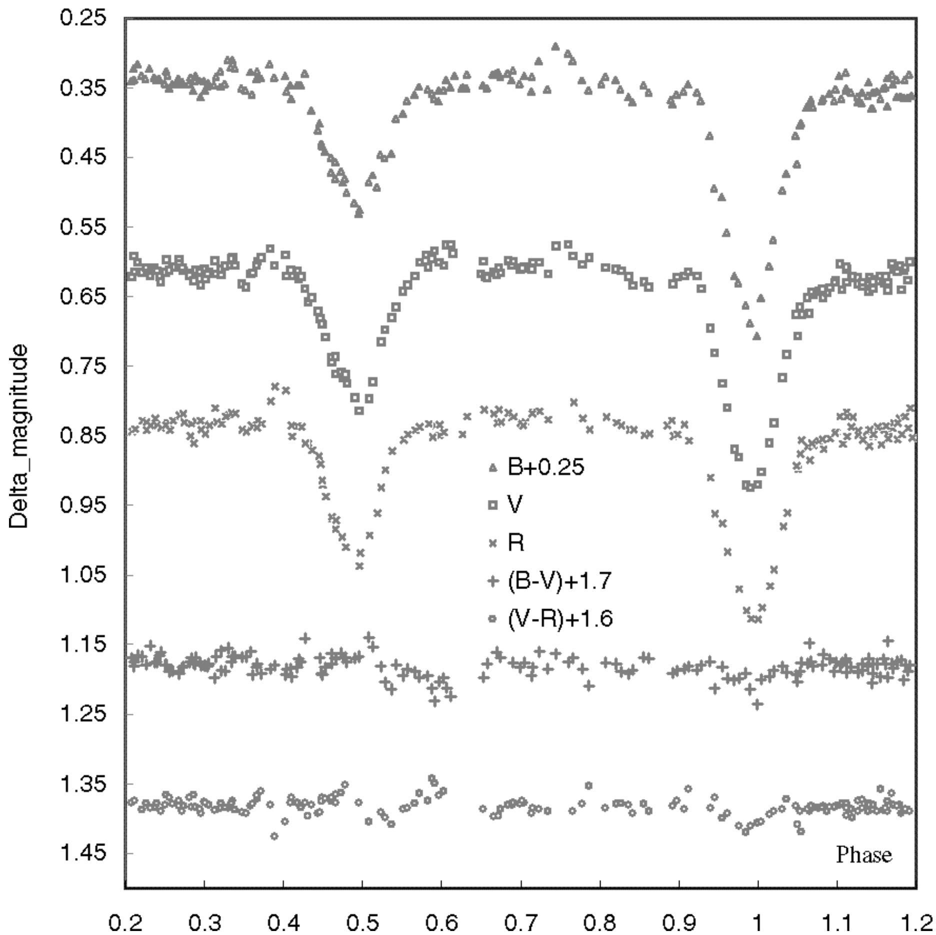

Figure 1. Light and color curves of MR Del

Remarks:

The relatively bright EA type eclipsing binary MR Del was discovered by HIPPARCOS (ESA, 1997). The photometric observations of the system by HIPPARCOS show an Algol type light curve. The variation range of this light curve is between from $8^{\mathrm{m}}.87$ to $9^{\mathrm{m}}.13$. (Note an apparent misidentification on this values in the SIMBAD database.) The mean orbital period derived by HIPPARCOS from the light curve fit is $0^{\mathrm{d}}.52169$ and the epoch is given as JD 2448500.5160 (ESA, 1997). Spectral type of the system is given as K0. MR Del was observed on 10, 13, 15, 16 and 18 July 2000 at the TÜBİTAK National Observatory. The light and color curves are plotted in Figure 1. The magnitudes are plotted relative to the comparison star in this figure. There are some small irregular variations in both $B-V$ and $V-R$ color curves.

Acknowledgements:

We would like to present our thanks to the TÜBİTAK National Observatory for partial financial and equipment support. This work also was supported by Çanakkale Onsekiz Mart University Research Fund.

Reference:

ESA, 1997, The Hipparcos and Tycho Catalogues, SP–1200

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INFORMATION BULLETIN ON VARIABLE STARS

Number 5154

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Budapest
9 August 2001

HU ISSN 0374 – 0676

BVR PHOTOMETRY OF CW CEPHEI

SOYDUGAN, E.[1]; DEMİRCAN, O.[1]; KESKİN, V.[2]; ERDEM, A.[1]; ÇİÇEK, C.[1]; ÖZDEMİR, S.[1]; BULUT, İ.[1]; SOYDUGAN, F.[1]

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[2] Ege University, Science Faculty, Department of Astronomy and Space Sciences, TR-35100 Bornova, Izmir, Turkey

Name of the object:
CW Cep = BD +62°2163 = HIP 113907 = HD 218066

Equatorial coordinates:	**Equinox:**
R.A.= $23^{h}04^{m}02\overset{s}{.}22$ **DEC.=** $+63°23'48\overset{''}{.}8$	2000

Observatory and telescope:
TÜBİTAK (Scientific and Technical Research Council of Turkey) National Observatory, 40-cm Cassegrain telescope

Detector:	Hamamatsu, R4457 (PMT)

Filter(s):	B, V and R filters of Johnson UBV system

Comparison star(s):	BD +62°2162 = HD 217979

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	EA

Remarks:
The history of the star can be found in Clausen and Gimenez (1991). New photometric observations of CW Cep were made on 14 nights during 2000 observing season at TÜBİTAK National Observatory. Three new times of minima were obtained from our observations by using well known method of Kwee and van Woerden (1956). New minima times are given in Table 1 and new light and color curves are shown in Figure 1.

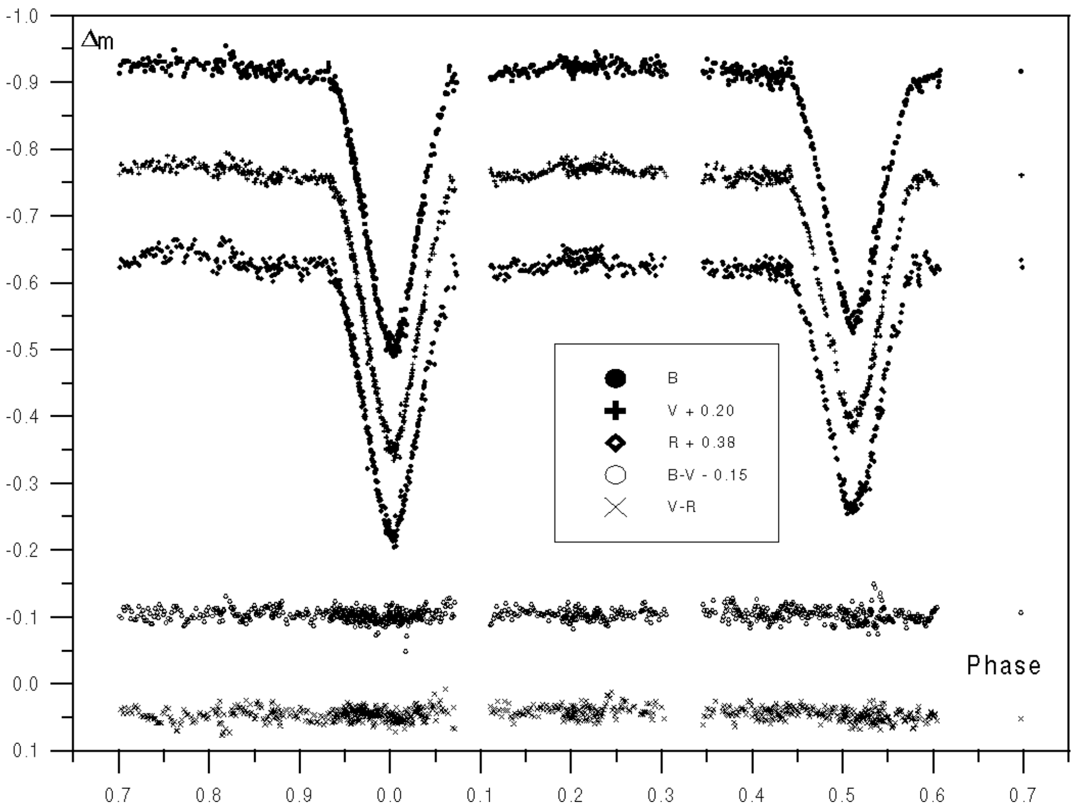

Figure 1. The light and color curves of CW Cep

Table 1: Minima times obtained in this work of CW Cep

JD Hel. 2400000 +	Min	Filter
51786.4812 ± 0.0011	I	BVR
51797.3977 ± 0.0010	I	BVR
51831.5383 ± 0.0016	II	BVR

Acknowledgements:

We would like to present our thanks to the TÜBİTAK National Observatory for partial financial and equipment support. This work also was supported by Çanakkale Onsekiz Mart University Research Fund.

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DETECTION OF THE SECONDARY MINIMA IN TX UMa

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TX UMa (HD 93033) is a well known bright ($V_{\rm max} = 7.0$, $V_{\rm min} = 8.7$) Algol-like eclipsing binary (B8V+F6IV) discovered independently by Rügemer (1931) and Schneller (1931). However, the photographic times of minima are available since 1903. The $O - C$ diagram (Kreiner et al., 2001) shows that the system exhibits rather peculiar orbital period variability that is not easy to explain by a single cause.

The observations of the system are complicated by its orbital period ($P \approx 3\overset{\rm d}{.}063$) which prevents quick coverage of the whole light curve. Due to the extreme shallowness of the secondary minimum ($\Delta V = 0.06$) and its long duration (9.7 h), the only available reliable minimum is at HJD 2444616.7811 (Oh & Chen, 1984). Its position relative to the primary minimum is important for the discussion of possible apsidal motion in the system suggested by Pearce (1940) and Payne-Gaposchkin (1942).

We present new primary minima times obtained between 1992 and 1998 ($UBVR$), the observations of the secondary minima taken in 1994 (JHK) and in 2001 (VR) and discuss the likelihood of proposed apsidal motion eventually present in the system.

Photoelectric $UBVR$ observations of TX UMa were obtained in 1992-8 and 2001 at the Skalnaté Pleso (SP) and Stará Lesná (SL) observatories of the Astronomical Institute of the Slovak Academy of Sciences. In both cases the 0.6-m Cassegrain telescope equipped with a single-channel photoelectric photometer was used. The stars HD 92764 = SAO 43442 ($V = 9.05$, $B = 9.27$, $U = 9.39$, sp. type A7) and HD 93213 = SAO 43467 ($V = 7.95$, $B = 8.44$, $U = 8.39$, sp. type F5) served as a comparison and check star, respectively.

Standard data reduction, atmospheric extinction correction and transformation to the UBV international system were carried out. Observations in the R passband and observation of the secondary minimum on February 15/16, 2001 were not transformed to the international system.

Photoelectric JHK observations of the secondary minimum in 1994 were obtained with the CVF instrument on the 1.5-m Carlos Sánchez IR telescope at the Observatorio del Teide (TO) in Tenerife, operated by the Instituto de Astrofísica de Canarias (IAC). Standard data reduction was performed using software available at the IAC.

Our new SP observations of TX UMa consist of 13 different primary minima (presented in Table 1), giving 40 individual minima times for $UBVR$ passbands. The minima times were determined by parabolic fits as well as by employing Kwee & Van Woerden (1956) method. The times obtained for our secondary minima as determined by the former method are given in Table 2.

Table 1: New mean times of the primary photoelectric minima determined from the $UBVR$ SP observations. The epochs were calculated using ephemeris (1). The errors are given in parentheses

Epoch	$\mathrm{JD}^{\mathrm{mean}}_{\mathrm{hel}}$	Epoch	$\mathrm{JD}^{\mathrm{mean}}_{\mathrm{hel}}$	Epoch	$\mathrm{JD}^{\mathrm{mean}}_{\mathrm{hel}}$
1038	2 448 643.4919(1)	1152	2 448 992.710(1)	1513	2 450 098.5640(5)
1039	2 448 646.5555(4)	1165	2 449 032.5337(4)	1527	2 450 141.4450(4)
1053	2 448 689.4419(6)	1194	2 449 121.3700(4)	1636	2 450 475.3497(2)
1150	2 448 986.5840(1)	1399	2 449 749.3480(7)	1637	2 450 478.4137(7)
				1795	2 450 962.4149(1)

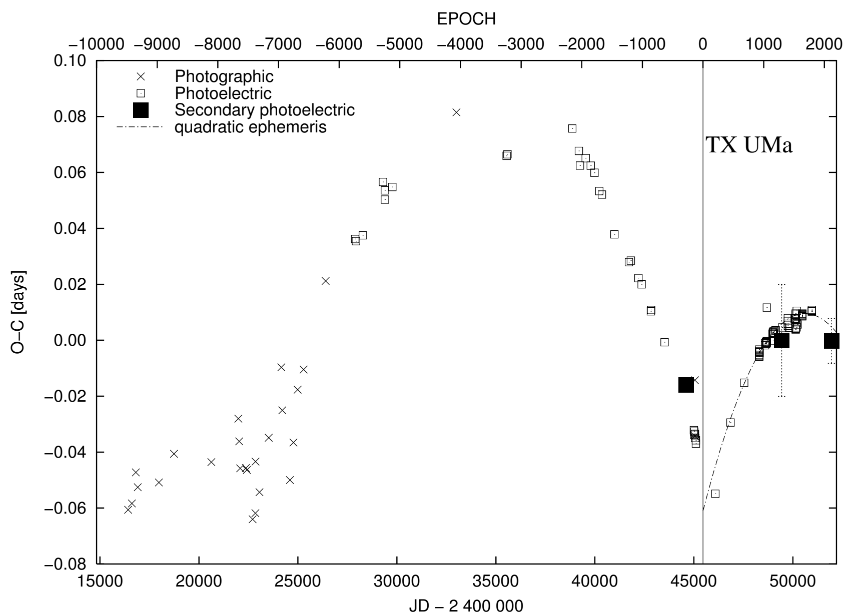

Figure 1. $O-C$ diagram for TX UMa

We combined our 40 primary minima times with other published 61 photoelectric and 27 photographic primary minima times (see e.g., Kreiner et al., 2001). The minima were weighted according to their standard errors (see Komžík, 1998). The least-square solution resulted in the following ephemeris:

$$\mathrm{Min\ I} = \mathrm{HJD}\ \underset{\pm 2}{2\,445\,463.797} + \underset{\pm 1}{3.063\,291} \times E. \tag{1}$$

The corresponding $O-C$ diagram is presented in Fig. 1. It is clearly seen, that 69 primary photoelectric minima times after 1992 can be approximated well by a parabolic fit with the following ephemeris:

$$\mathrm{Min\ I} = \mathrm{HJD}\ \underset{\pm 3}{2\,445\,463.736} + \underset{\pm 5}{3.063\,375} \times E - \underset{\pm 2}{2.5} \times 10^{-8} \times E^2. \tag{2}$$

Table 2: New times of the photoelectric secondary minima. The epochs were calculated using ephemeris (1). The errors are given in parentheses

Epoch	JD_{hel}	Filter	$JD_{hel}^{weighted\ mean}$	Obs.
1297.5	2 449 438.40(5)	J		TO
1297.5	2 449 438.42(3)	H		TO
1297.5	2 449 438.42(3)	K	2 449 438.417(20)	TO
2119.5	2 451 956.442(8)	V		SL
2119.5	2 451 956.445(40)	R	2 451 956.442(8)	SP

Our secondary minima observations performed on March 26/27, 1994 and February 15/16, 2001 are displayed on Figs. 2 and 3, respectively. The phases were calculated using the ephemeris given in Eq. (2).

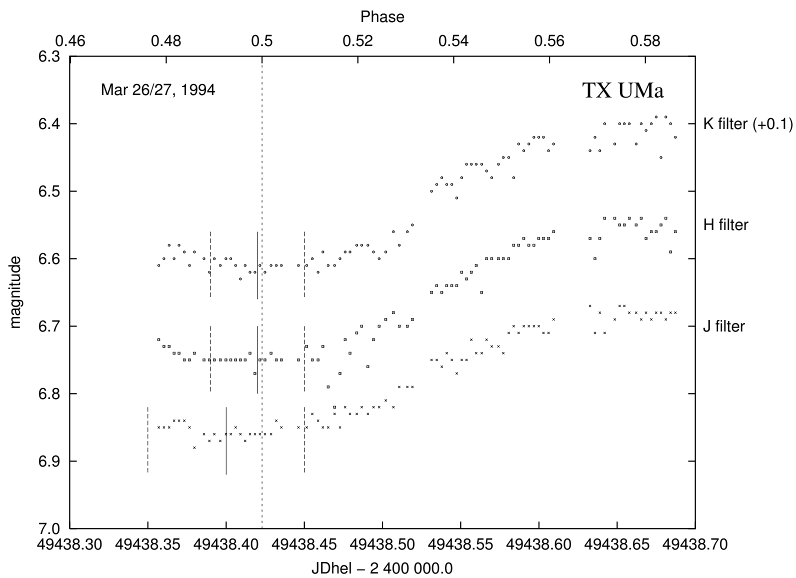

Figure 2. The secondary minimum in J, H, K (full vertical line: minimum, dashed: standard errors)

The $O-C$ diagram (Fig. 1) shows that the orbital period variations of this semi-detached binary are very complex. Long intervals of (almost) constant period were suddenly interrupted by period jumps, while recent times of minima suggest a continuous period decrease.

Plavec (1960) and Rovithis-Livaniou et al. (1998) found a 34 years periodicity in the $O-C$ residuals of the primary minima. The authors suggested apsidal motion as a likely explanation of the observed period changes. According to Todoran & Roman (1992) the observed period changes could be caused by the apsidal motion superimposed on a light-time effect or strong period variations due to mass exchange.

The reality and amplitude of the apsidal motion can be tested by the shifts of the secondary minima with respect to phase 0.5, as determined from the primary minima. Now we have at disposal three independent minima times obtained in 1981 (Oh & Chen, 1984), 1994 and 2001 (Table 1). The first one is shifted from phase 0.5 by $+0\overset{d}{.}0085$, the second and third one by $-0\overset{d}{.}006$ and $-0\overset{d}{.}005$, respectively.

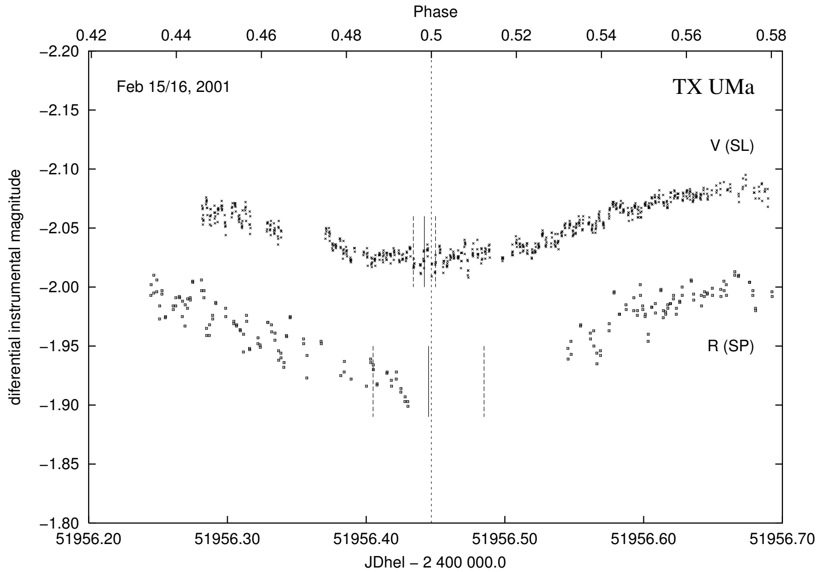

Figure 3. The secondary minimum in V, R (full vertical line: minimum, dashed: standard errors)

Thus, it is apparent that apsidal motion alone cannot explain the observed orbital period changes. Other explanations such as light-time effect, Applegate's mechanism and mass transfer are still viable.

Detailed photometric and spectroscopic analysis of all available data necessary to decipher the causes of such behaviour will be presented in a forthcoming paper.

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NSV 25616 IS A NEW CLASSICAL CEPHEID

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Name of the object:
NSV 25616 = TYC2 3598 937 1 = GSC 3598.0937 = No. 1083 (NGC 7092) (Platais, 1988)

Equatorial coordinates:	**Equinox:**
R.A.= $21^{\mathrm{h}}28^{\mathrm{m}}44\overset{\mathrm{s}}{.}93$ **DEC.=** $+48°58'41\overset{''}{.}6$	J2000.0

Observatory and telescope:
40-cm astrograph in Crimea

Detector:	Photoplate

Filter(s):	None

Comparison star(s):	GSC 3598.0695, $B_{\mathrm{pg}} = 11\overset{\mathrm{m}}{.}36$; GSC 3598.0933, $B_{\mathrm{pg}} = 11\overset{\mathrm{m}}{.}93$; GSC 3598.0147, $B_{\mathrm{pg}} = 12\overset{\mathrm{m}}{.}25$; GSC 3598.1205, $B_{\mathrm{pg}} = 12\overset{\mathrm{m}}{.}50$

Transformed to a standard system:	B_{pg}
Standard stars (field) used:	Derived from comparison with B magnitudes of the Tycho catalog (ESA, 1997)

Availability of the data:
Upon request

Type of variability:	DCEP

Remarks:

The variability of the star No. 1083 in the open cluster NGC 7093 = M 39, later included in the catalog of suspected variables as NSV 25616, was supposed by Platais (1988) who had considered it a possible Cepheid, presumably on the grounds of its spectral type (G2). We estimated by eye the brightness of the variable on 188 plates from Moscow archive, JD 2433483–49634. The star is a classical Cepheid with the following light elements:

$$\mathrm{JD}_{\max} = 2441958.37 + 7\overset{\mathrm{d}}{.}9666 \times E.$$

The variability range from our estimates is $11\overset{\mathrm{m}}{.}8$–$12\overset{\mathrm{m}}{.}3$; this range seems somewhat too small, maybe indicating that the magnitudes of the comparison stars need improvement. The hump on the descending branch is characteristic of classical Cepheids with similar period values. Max − min = $0\overset{\mathrm{P}}{.}35$. The phased light curve is given in Fig. 1.

Acknowledgements:

Thanks are due to S.V. Antipin and N.N. Samus for their attention and assistance.

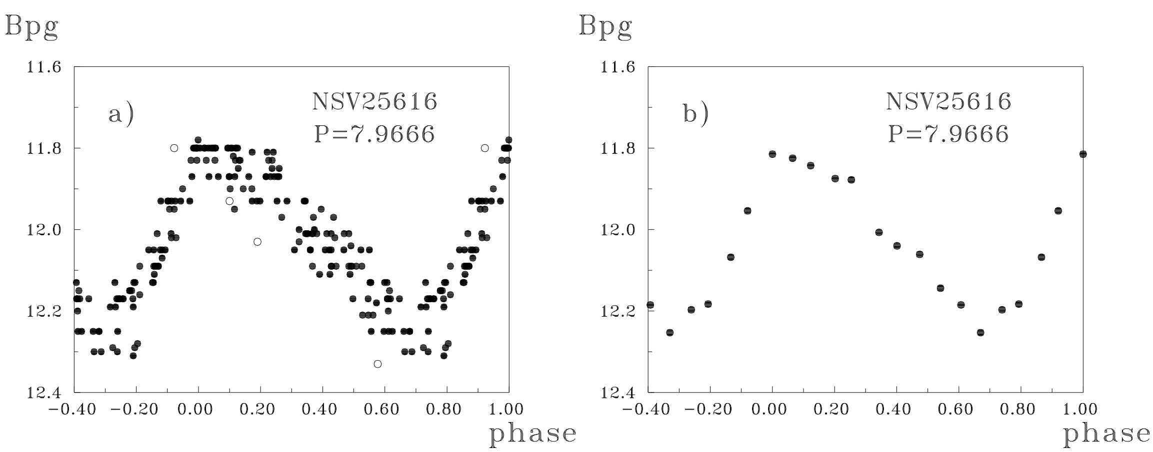

Figure 1. The phased light curve (a) and the mean phased light curve (b). Uncertain estimates are shown as open circles

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THE SU UMa NATURE OF V630 CYGNI

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V630 Cyg was discovered and designated as S 4556 by Hoffmeister (1949). Romano (1966) observed this star and found that V630 Cyg shows frequent short and long outbursts, which is very suggestive of an SU UMa-type dwarf nova. Then, the star has been regularly monitored as a candidate SU UMa-type dwarf nova by a number of amateur observers. Wenzel (1989) also detected apparent superoutbursts. Bruch & Schimpke (1992) obtained an optical spectrum with the weak Balmer emission lines which does not well agree with the normal behavior of SU UMa stars. Cordova et al. (1981) reported that V630 Cyg was not detected during a survey with *HEAO-1* in soft X-rays. Nogami et al. (1997) measured that the recurrence cycle of long outburst is 290 d and that of short outburst is 30–50 d.

Table 1: The observation summary

Date	HJD start[1]	HJD end[1]	Exposure time (s)	Error[2]	Mean V mag[3]	N[4]
17 August, 1996	50313.054	50313.060	90	0.01	2.419	5
18	50313.958	50314.086	90	0.02	2.531	112
19	50315.187	50315.293	90	0.02	2.719	93
20	50316.209	50316.297	90	0.04	2.911	72
21	50317.217	50317.222	60	0.03	4.035	5
5 September, 1996	50332.097	50332.103	90	0.25	5.949	5
10 July, 1999	51370.497	51370.579	30	0.05	2.559	200
11	51371.466	51371.549	30	0.05	2.647	200
12	51372.470	51372.552	30	0.07	2.739	199

[1] HJD − 2400000
[2] Nominal error for each point
[3] Magnitude relative to the local standard star GSC 0318701786 (GSC mag = 12.18)
[4] Number of frames

To investigate the nature of V630 Cyg, we carried out time-resolved photometry during outbursts caught by P. Skalak (Vanmunster 1996) in 1996 and by Poyner (1999) in 1999.

In 1996, we performed the observations at Ouda Station, Kyoto University. A 60-cm reflector (focal length = 4.8 m) and a Thomson TH 7882 CCD camera with a Johnson-V filter attached to the Cassegrain focus were used (for more information of the instruments, see Ohtani et al. 1992). In 1999, the observations were carried out at the Conder Brow Observatory using an unfiltered CCD camera (SXL8) and a 33-cm Newtonian telescope. Table 1 gives the journal of the observations.

After standard de-biasing and flat fielding, the Ouda frames were processed by a microcomputer-based aperture photometry package developed by one of the authors (TK). The software used to reduce the raw Conder Brow data was developed by Nick James in England and performed standard de-biasing and flat fielding prior to processing using an aperture-based photometry programme. Magnitudes of V630 Cyg were measured relative to the local comparison star GSC 0318701786 (GSC mag = 12.18). The local check star GSC 0318700683 was used to confirm the constancy of the comparison within $0^{\mathrm{m}}_{.}02$ during our observations and measure the nominal error for each data point.

Figure 1 shows the light curve of the 1996 August outburst. Since Skalak noticed this outburst on August 10 (HJD 2450306), the outburst lasted at least 11 days. Periodic modulations were clearly superposed on the slow decline trend (0.17 mag d^{-1}) between August 18 and 20. After removing the decline trend, we performed a period analysis by the phase dispersion minimization (PDM) method (Stellingwerf 1987). The best estimated period is 0.0789 ($\pm$ 0.0004) d (Figure 2a), and definite superhumps of this period is seen in Figure 2b, confirming the SU UMa nature of V630 Cyg.

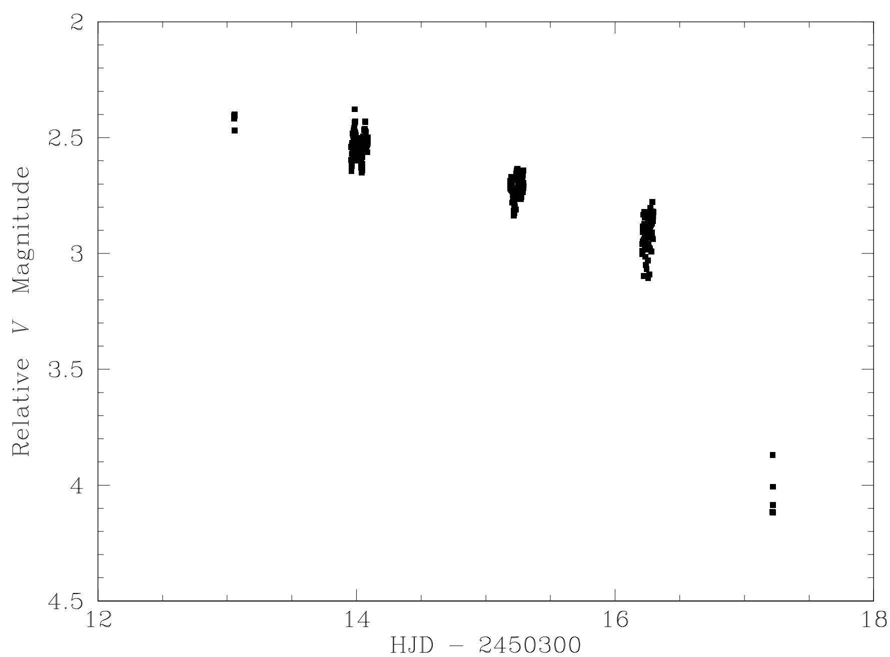

Figure 1. Light curve of the 1996 August outburst

V630 Cyg entered the rapid decline phase of the superoutburst and became fainter by $1^{\mathrm{m}}_{.}1$ between our observations on August 20 and 21. Two weeks after, on September 5, the relative magnitude of V630 Cyg was 5.95 ± 0.05 mag, indicating that the amplitude of the superoutburst is larger than $3^{\mathrm{m}}_{.}53$. This is a normal value of an SU UMa-type dwarf nova (see e.g. Nogami et al. 1997).

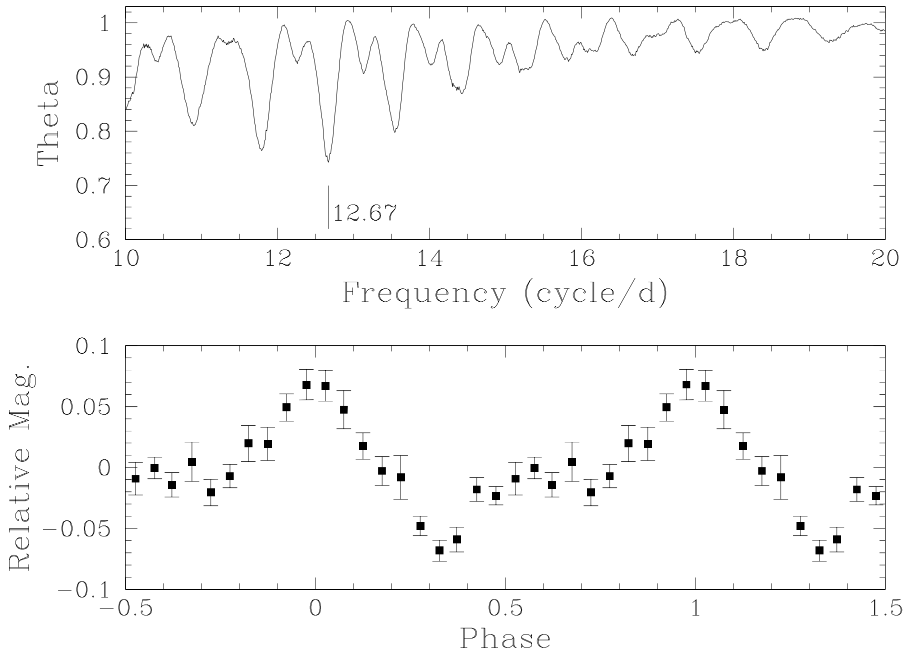

Figure 2. (upper panel, a) Theta diagram of the PDM analysis for the data between 1996 August 18 and 20, clearly indicating $f = 12.67 \pm 0.07$ d^{-1} ($P = 0.0789 \pm 0.0004$ d) as the best estimated superhump period. (lower panel, b) Superhump light curve folded by the superhump period

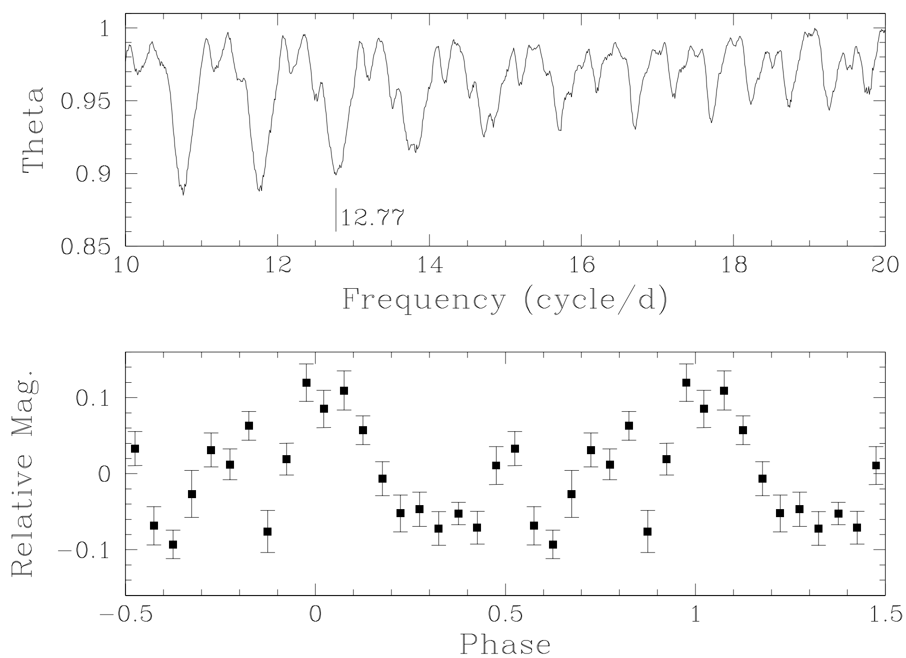

Figure 3. (upper panel, a) Theta diagram of the PDM analysis for the data obtained during the 1999 outburst. The best estimated period is $P = 0.0783 \pm 0.0008$ d ($f = 12.77 \pm 0.13$ d^{-1}), which is in accordance with the superhump period obtained in the 1996 outburst within the error. The other periods pointed by peaks with higher significance are rejected by manual period analysis. (lower panel, b) Superhump light curve folded by $P = 0\overset{d}{.}0783$

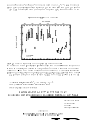

Table 2: Outbursts of V630 Cyg

JD start	peak mag	duration (d)	type	JD start	peak mag	duration (d)	type
2449888	14.5	3	normal	2450725	15.1	2	normal
2449935	15.1	1	normal	2450755	13.9	10	super
2449980	14.2	2	normal	2450896	14.6	2	normal
2449987	14.5	2	normal	2451069	14.2	13	super
2450012	14.1	1	normal	2451367	13.8	7	super
2450016	14.0	5	normal	2451464	14.8	2	normal
2450226	15.5	1[a]	normal	2451688	14.5	1[a]	normal
2450274	14.2	4	normal	2451823	14.5	2	normal
2450306	14.0	12	super	2451834	14.9	3	normal
2450610	14.3	8	super	2451875	14.8	1[a]	normal
2450680	15.5	2	normal	2451878	15.3	1[a]	normal

[a] single observation

We again performed time-resolved photometry during a long outburst detected by Poyner (1999) on 1999 July 8. The theta diagram for the de-trended data obtained between July 10 and 12 is exhibited in Figure 3a, suggesting the period $P = 0.0783 \pm 0.0008$ d accordant with the superhump period measured above. Figure 3b shows the superhumps in this superoutburst.

All outbursts reported to VSNET (http://www.kusastro.kyoto-u.ac.jp/vsnet/) since 1995 are summarized in Table 2. Since V630 Cyg has been very closely monitored by many amateur observers, it is a rare case that a superoutburst is missed. The shortest recurrence cycle of superoutburst is 145 d, but seems to vary to exceed several hundred days in these several years. The recurrence cycle of normal outburst is also unstable. V630 Cyg may become a key object for study of variation of mass transfer rate and solar-type cycle in the secondary star.

The authors are very thankful to vigorous amateur observers for reporting their useful observations to VSNET.

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Table 1: Outbursts of FS And

JD at max	peak mag	d[a] (d)	JD at max	peak mag	d[a] (d)
2449659	17.0	-[b]	2450040	15.8	< 3
2449681	16.7	-	2450333	15.4	-
2449694	16.5	-	2450345	15.7	-
2449997	16.6	-	2450361	15.0	-
2450005	15.5	3	2450711	15.5	-
2450016	15.6	2	2450744	15.7	-
2450026	15.8	< 6			

[a] Outburst duration.
[b] Not determined (too few data).

package developed by one of the authors (TK). The magnitudes were determined relative to GSC 1333.247, whose Tycho-2 magnitude is $V = 10.78 \pm 0.10$ and $B-V = +0.57 \pm 0.14$. The constancy of comparison star during the run was confirmed by comparison with GSC 1333.543 and GSC 1333.680. The light curve drawn from these observations is presented in Figure 1.

Three distinct outbursts were observed during this period: short outbursts on JD 2451481 and 2451493, and a long outburst starting on JD 2451522. The interval of the first two outbursts is only 12 d. The interval between the second and third being 29 d, it is likely one outburst was missed between the second and third outbursts. The true cycle length is thus likely 1/4 of the GCVS period. The first and second outburst decayed very quickly, with a rate of decline exceeding 1 mag d^{-1}, which is characteristic of normal outbursts of SU UMa-type dwarf novae. The third outburst lasted more than 11 d, which is very characteristic of a superoutburst. The observed outburst pattern suggests that UV Gem is an SU UMa-type dwarf nova with a short cycle length. This seems to be consistent with the high mass-transfer rate inferred from spectroscopy.

FS And is a dwarf nova discovered by Hoffmeister (1967). He reported relatively frequent detections of outbursts. The object was studied by Meinunger (1986), who reported an approximate outburst cycle length of $\sim$ 10 d, and the presence of a possible standstill. The object has been classified as a possible Z Cam star based on this observation. However, the lack of detailed published photometry has made the detailed classification slightly ambiguous. Bruch (1989) obtained spectroscopy and confirmed the dwarf nova classification.

We observed FS And in order to study its outburst behavior. We took three V-band data at Ouda Station, Kyoto University (Ohtani et al. 1992), between 1996 September 10 and 17. We further studied unfiltered CCD observations reported to the public database of the VSOLJ (Variable Star Observers League in Japan), and VSNET (http://www.kusastro.kyoto-u.ac.jp/vsnet/). The former contains observations by M. Iida, and the latter those by L. T. Jensen. Although zero-point calibrations were rather uncertain for unfiltered CCD observations, the zero-point error seems to be smaller than $\sim 0^{\mathrm{m}}.3$ by comparison with the Ouda data. This degree of uncertainty will not affect the analysis of the overall outburst behavior. Table 1 lists the observed maxima of outbursts.

The shortest observed interval between successive outbursts was 8 d, which generally confirmed the cycle length reported by Meinunger (1986). All observed outbursts faded quickly. Figure 2 represents the best observed portion of the light curve. Frequent short outbursts are clearly seen on Figure 2. The mean interval between these outbursts was

10 d. The quick fade from the outburst maxima is not characteristic of a Z Cam star (or a short period SS Cyg star) having this cycle length. The characteristics of outbursts more resemble those of a frequently outbursting SU UMa-type dwarf nova, best exemplified by HS Vir (Kato 1995; Kato et al. 1998), which showed similar frequent, short outbursts recurring with a period of 8 d. From these similarities, we propose that FS And is a good candidate for an SU UMa-type dwarf nova. The possible "standstill" reported by Meinunger (1986) may have been a superoutburst. Further monitoring for outbursts is strongly recommended.

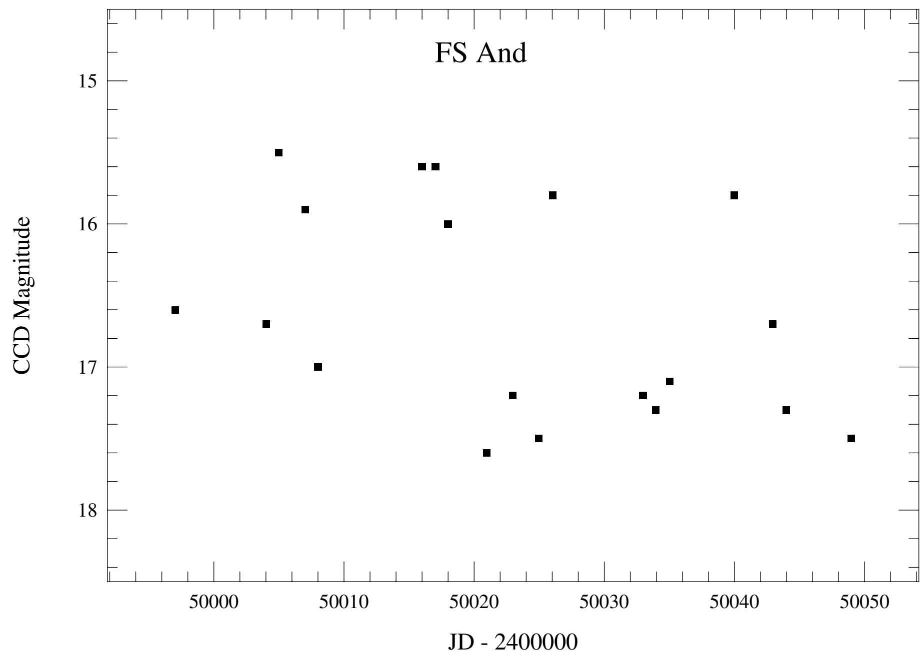

Figure 2. Light curve of FS And. Frequent, short outbursts with a recurrence time of $\sim$ 10 d are seen

AS Psc (= S 10828) was originally discovered as an eruptive variable reaching $B = 16.5$ in 1963 in the vicinity of the galaxy M33 (Richter 1979). Since no other outbursts were detected between 1963 and 1980 (Richter 1979), the star was suspected to be a nova in M33. The second outburst was detected in 1980 (Sharov 1982), which made a long-period dwarf nova more likely. However, the possibility of a recurrent nova in M33 remained (Richter 1983). Since then, three more outbursts were detected, at least one of which faded very quickly (Sharov 1988). Together with the shortest interval of 293 d between outbursts, the object is now considered to be a dwarf nova with rather infrequent outbursts (Richter 1989). Richter (1989) listed all the observations of five known outbursts. From the lack of the visible counterpart on POSS and other deep exposures, the quiescent magnitude is considered to be fainter than $B = 21.7$. Combined with the brightest observed maximum, reaching $B = 15.3$, the total amplitude of outburst is larger than 6.4, which makes AS Psc a good candidate of an SU UMa-type dwarf nova.

Further evidence for an SU UMa-type dwarf nova can be found in the extremely rapid decline (1.6 mag d^{-1}), observed on the occasion of the 1984 outburst. This rate of decline corresponds to that of a normal outburst of an SU UMa-type dwarf nova with a short orbital period. If AS Psc is indeed an SU UMa-type dwarf nova, the bimodal distribution of outbursts (normal outbursts and superoutbursts) would make the simple statistical analysis of outbursts by Richter (1989) misleading. No further outburst has been reported both in the literature and to VSNET.

While surveying exposures taken by the members of Kyoto University Astronomy Lovers' Association, the authors found a new outburst of AS Psc occurring in 1989 October. The exposure was taken by Mr. Nishida with a hypersensitized TP 2415 film and a 13-cm reflector on JD 2447801.231. The exposure clearly showed AS Psc in outburst. Using V-magnitude comparison stars for TX Tri, we estimated the magnitude of the variable as 16.3. The outburst occurred 1028 d after the last known outburst in 1986.

Looking at available materials (summarized in Richter 1989), the existence of two types outbursts is evident: short or faint outbursts, as in JD 2444461 and 2445964, and long or bright outbursts. Such a bimodal distribution is consistent with the supposed classification of an SU UMa-type dwarf nova. By assuming that outbursts reaching $16\overset{\mathrm{m}}{.}5$ are long, bright outbursts (likely superoutbursts), there is a clear indication of regular intervals between them. The interval between the 1983 and 1986 outbursts is 1102 d, which is close to interval of 1028 d between the 1986 and 1989 outbursts. The interval of 7384 d between the 1963 and 1983 outbursts may be 7 times of this fundamental period. The available material thus suggests that the supercycle of AS Psc is 1000–1100 d, which is an intermediate value between WZ Sge-type dwarf novae and usual SU UMa-type dwarf novae (c.f. Nogami et al. 1997). Although there still remains a possibility that the true supercycle could be N-th of this value, the large outburst amplitude seems to be consistent with a long supercycle. Further observations to search for outbursts, and time-resolved photometry to search for superhumps are strongly encouraged.

We are grateful to M. Iida for providing observations, and the manager of the VSOLJ for making them publicly available. We are also grateful to L. T. Jensen for providing observations of FS And. The author is grateful for Kyoto University Astronomy Lovers' Association and Mr. Nishida for providing photographs for the author's examination. Part of this work is supported by a Research Fellowship of the Japan Society for the Promotion of Science for Young Scientists (MU).

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ON THE SUPERCYCLE OF TWO ECLIPSING SU UMa-TYPE DWARF NOVAE: V2051 Oph AND IY UMa

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V2051 Oph is a short-period eclipsing cataclysmic variable whose exact nature was a matter of controversy for a long time. Some authors suspected it to be a dwarf nova, while extensive studies by Warner and O'Donoghue (1987) proposed a low-field polar (synchronously rotating magnetic cataclysmic variable). It was only recently that regular detections of outbursts by amateur astronomers confirmed the dwarf nova nature, and finally Kiyota and Kato (1998) discovered superhumps, which led to a conclusion to the long-lasting controversy. The star is now recognized as a member of rare class of SU UMa-type dwarf novae, which show deep eclipses even during outbursts. Only a handful of such objects are known: Z Cha, OY Car, HT Cas, DV UMa and IY UMa, the last one of which will be discussed later in this paper. All of them have provided a wealth information about the structure of accretion disks.

Since past observation of V2051 Oph suggested relatively unusual spectroscopic and photometric features (Warner and O'Donoghue 1987), the next question is whether V2051 Oph shows typical outburst behavior as seen in other SU UMa-type dwarf novae. Thanks to the recent intensive visual monitoring, as a part of VSNET Collaboration (http://www.kusastro.kyoto-u.ac.jp/vsnet/), many outbursts have been detected. However, since V2051 Oph lies close to the ecliptic, some outbursts are inevitably missed because of solar conjunctions and the interference by the Moon. Table 1 lists the detected outbursts since 1997 August. V2051 Oph was sometimes more frequently detected around 14.5 mag, than in other observing seasons. It is not clear whether these detections were short normal outbursts, or enhanced activity in quiescence, as is sometimes observed in high-inclination systems (cf. Richter and Greiner (1995) for alternations between high/low states in a high-inclination dwarf nova, IR Com; see also http://www.kusastro.kyoto-u.ac.jp/vsnet/LClast/index/PEGIP.html for a recent example of IP Peg). Figure 1 shows the light curve drawn from these data. CCD observations (G.G. and S.K.) are also plotted. Large dispersions of magnitudes in most part reflect orbital variations caused by eclipses.

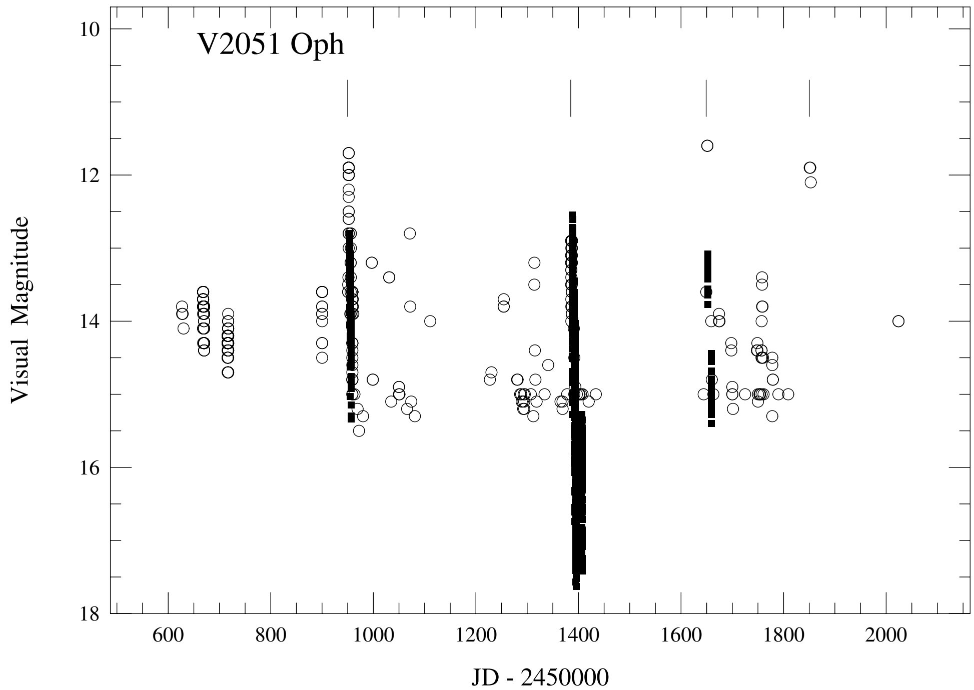

Figure 1. Overall light curve of V2051 Oph. Filled and open symbols represent CCD and visual observations, respectively. The superoutbursts are marked with ticks. Upper limit observations are not plotted for simplicity

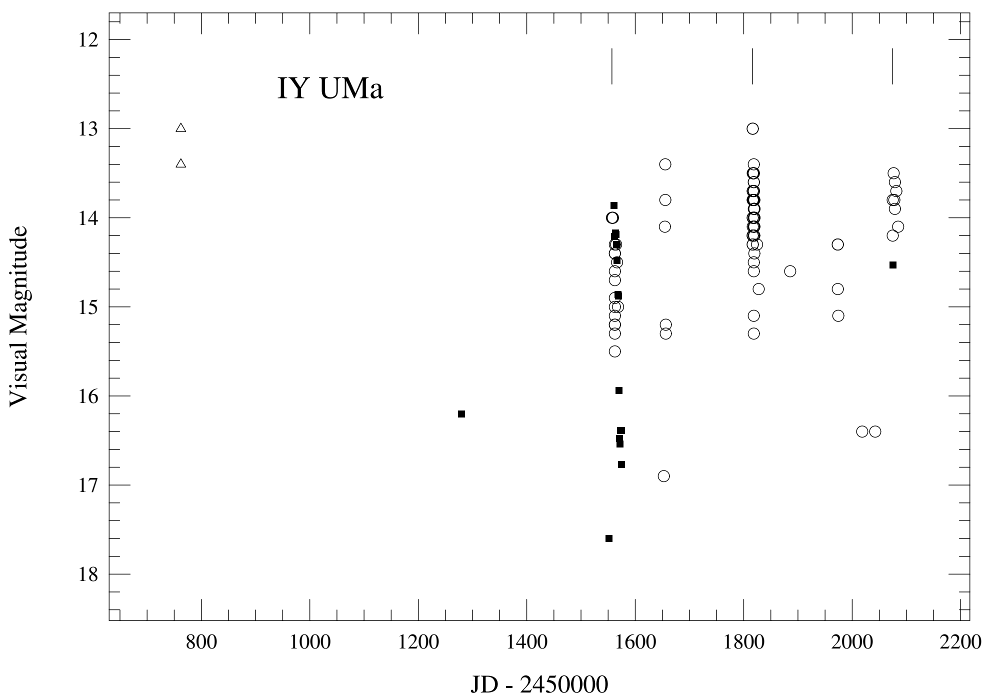

Figure 2. Overall light curve of IY UMa. Filled and open symbols represent CCD and visual observations, respectively. The first two open triangles are photographic discovery observations by Takamizawa. The superoutbursts are marked with ticks. Upper limit observations are not plotted for simplicity

Table 1: Outbursts of V2051 Oph

JD start	peak mag	d[a] (d)	type	JD start	peak mag	d[a] (d)	type
2450626	13.8	3	normal	2451313	13.2	2	normal
2450668	13.6	3	normal	2451340	14.6	1	normal[c]
2450715	14.1	2	normal	2451385	12.9	8	super
2450900	13.6	1	normal	2451649	11.6	11	super
2450950	11.7	13	super	2451674	13.9	1	normal
2450996	13.2	3	normal	2451697	14.3	1	normal[c]
2451030	13.4	3	normal	2451747	14.3	2	normal
2451071	12.8	2	normal	2451756	13.8	3	normal
2451110	14.0	1[b]	normal	2451777	14.5	2	normal[c]
2451227	14.7	3	normal[c]	2451850	11.9	> 3	super
2451254	13.7	> 1	normal	2452024	14.0	1	normal
2451280	14.8	2	normal[c]				

[a] Duration of outburst (brighter than mag 15).

[b] Single estimate.

[c] Enhanced activity in quiescence?

As is evident from Table 1 and Figure 1, four definite superoutbursts were observed. The shortest interval between them was 201 d. The interval between the first and second being close to the double this period, there should have been a missed superoutburst during the conjunction period. The average supercycle, by assuming this presumably missed superoutburst, is 227 d. This is a quite typical supercycle for a relatively active SU UMa type dwarf nova (cf. Nogami et al. 1997). The cycle length of normal outbursts is more difficult to determine, but since the epochs of the first seven outbursts are well represented by a period of 45 d, this period may be a good candidate for the cycle length. However, if fainter brightenings to $\sim 14.^{\mathrm{m}}5$, observed between JD 2451110 and 2451777, are indeed normal outbursts, the cycle length of normal outbursts may need to be halved. In either cases, both the supercycle length and the cycle length of normal outbursts fall within a region occupied by usual SU UMa-type dwarf novae (cf. Nogami et al. 1997). This suggests that V2051 Oph is a fairly normal SU UMa-type dwarf nova, in terms of its outburst activity. This existence of a bright deeply eclipsing, fairly normal SU UMa-type dwarf nova would provide a promising tool for future detailed observations of accretion process in cataclysmic variables.

IY UMa (= TmzV85) was discovered by Takamizawa as a dwarf nova. Subsequent observations during the 2000 January outburst revealed that the object is a rare, deeply eclipsing SU UMa-type dwarf nova (Uemura et al. 2000a,b). Based on the observations of this superoutburst and other information, a number of authors suggested that IY UMa has a supercycle length comparable to southern eclipsing SU UMa-type dwarf novae (Uemura et al. 2000b; Patterson et al. 2000). However, the reliable determination of the supercycle length should require further detections of superoutbursts.

Based on the observations reported to the VSNET Collaboration, we have been able to identify seven outbursts (Table 2 and Figure 2), three of which (even disregarding the initial detection by Takamizawa) are superoutbursts. The last three superoutbursts occurred with a rigorous recurrent period of 285.5 d. Takamizawa's initial detection could be a superoutburst three cycles before the JD 2451557 outburst, but this is not conclusive because of a rather large $O-C$ of 61 d against the recent ephemeris. Whether this could

Table 2: Outbursts of IY UMa

JD start	peak mag	d[a] (d)	type	JD start	peak mag	d[a] (d)	type
2450762	13.0	-	super?	2451885	14.6[b]	-	normal
2451557	14.0	14	super	2451973	14.3	2	normal
2451654	13.4	3	normal	2452074	13.5	> 10	super
2451816	13.0	> 11	super				

[a] Duration of outburst.

[b] Single observation.

represent a change in the supercycle length needs to be tested by future observations.

The shortest interval between successive outbursts, including normal outbursts, was 69 d. This cycle length of normal outbursts is typical for an SU UMa-type dwarf nova with a supercycle length of 285.5 d.

In conclusion, IY UMa is confirmed to be the first, long-wanted, deeply eclipsing bright SU UMa-type dwarf nova in the northern hemisphere, which has typical outburst characteristics of a normal SU UMa-type dwarf nova.

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BVR PHOTOMETRY OF THE SHORT-PERIOD ALGOL SYSTEM VV UMa

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We present new B, V, R light curves solutions of VV UMa. This Algol short-period binary was our main target in a number of different observing runs performed between January 1997 to March 2000. The observations were carried out with the 80-cm telescope at the Observatorio del Teide (Canary Islands, Spain). The telescope is equipped with a Thomson 1024×1024 CCD and broad band B, V and R Johnson filters (see Table 1). The CCD field is $7' \times 7'$. For comparison the brightest star in close proximity to VV UMa was used. The star is not catalogued and it is located about $1\farcm5$ south and $2'$ east of VV UMa (Figure 1). The data reduction was performed using the *IRAF*[1] photometry package. The estimated errors of the photometry are less than $0\fm01$. The orbital phases were calculated using the ephemeris given by Šimon (1996), namely, HJD $= 2445006.2873 + 0\fd68735545 \times E$.

Table 1: Observing run

Observation date	Observed filters
25–26 March 1997	B, V, R
28–29 January 1999	B, V, R
29–30 January 1999	B, V, R
1–2 February 1999	B, V, R
5–6 March 1999	B, V
6–7 March 1999	B, V
19–20 December 1999	B, V, R
20–21 December 1999	B, V, R
21–22 December 1999	V, R
28–29 February 2000	V
29 February–1 March 2000	V
16–17 March 2000	V

[1] IRAF is distributed by the National Optical Astronomy Observatories

Figure 1. Identification chart ($'7 \times 7'$) of VV UMa, in the center, with North up and East to the left. The comparison star is the brightest in the lower left quarter of the field

As far as we know only two sets of photometric broad band U, B and V light curves have been published by Wilson (1965) and Broglia & Conconi (1977). They give light curves solutions using different codes. Later these light curves were also analysed by Pustylnik (1969), Horak (1966) and Rafert (1990). We have analyzed our new light curves using the code *ILOT* based on the Limit Optimization Technique (Budding & Zeilik 1987). The V light curves observed in the years 1997+1999 and 2000 were analyzed individually in order to avoid the intrinsic variability. Different sets of initial values, taken from previously published determinations, were used in different fits for each individual light curve. The temperatures were always fixed parameters adopting $T_1 = 9200$ K and $T_2 = 5500$ K. The limb-darkening coefficients were taken from the Claret et al. (1995) and Díaz-Cordovés et al. (1995) determinations.

As Figure 2 shows the models together with the observations and Table 2 lists the physical parameters yielded by the best fits. The analysis of *uvby* Strömgren light curves with *ILOT* suggested two possible solutions: $k = r_2/r_1 \approx 0.70$ and $i \approx 84^\circ$ or $k = r_2/r_1 \approx 0.82$ and $i \approx 80^\circ$, while the fits with a new code, *BINAROCHE*, yielded $i \approx 80^\circ$–81° (Lázaro et al. 2001). From our B, V and R light curves analysis with *ILOT* it seems that both solutions are possible, but the results of the Strömgren light curves with *BINAROCHE* suggest that the lower value of inclination angle is preferred.

Table 2: *ILOT* light curve solutions

	1997+1999 B filter	1997+1999 V filter	1997+1999 R filter	2000 V filter
L_1	0.962 ± 0.002	0.958 ± 0.002	0.909 ± 0.002	0.936 ± 0.002
L_2	0.037 ± 0.002	0.041 ± 0.002	0.091 ± 0.002	0.063 ± 0.002
r_1	0.346 ± 0.001	0.355 ± 0.001	0.355 ± 0.001	0.352 ± 0.001
r_2	0.269 ± 0.001	0.277 ± 0.001	0.284 ± 0.001	0.279 ± 0.001
k	0.78	0.78	0.80	0.80
i	$81^{\circ} \pm 0^{\circ}\!.1$	$80^{\circ} \pm 0^{\circ}\!.1$	$79^{\circ} \pm 0^{\circ}\!.1$	$80^{\circ} \pm 0^{\circ}\!.1$
χ^2	370	110	150	400
ε	0.01	0.01	0.01	0.01
N. points	320	400	340	701

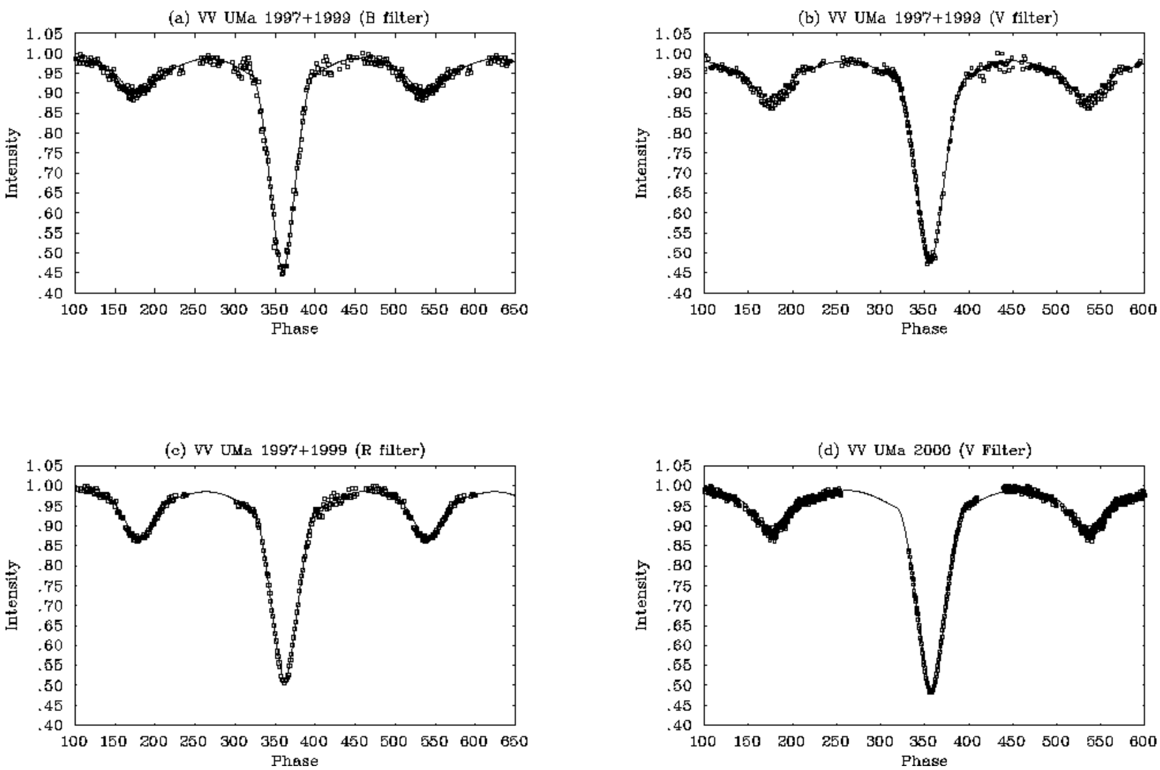

Figure 2. Observed light curves and the fits obtained with *ILOT*

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V1542 Aql IS AN ECLIPSING BINARY OF W UMa TYPE

(BAV MITTEILUNGEN NO. 138)

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Name of the object:
V1542 Aql = GSC 1057.01309 = Brh V8

Equatorial coordinates:	**Equinox:**
R.A.= $19^{\mathrm{h}}46^{\mathrm{m}}25\overset{\mathrm{s}}{.}1$ **DEC.**= $+08^{\circ}45'12''$	2000

Observatory and telescope:
W. Quester: Private observatory, 20-cm Cassegrain telescope $f/6.4$;
K. Bernhard: Private observatory, 20-cm Schmidt–Cassegrain telescope

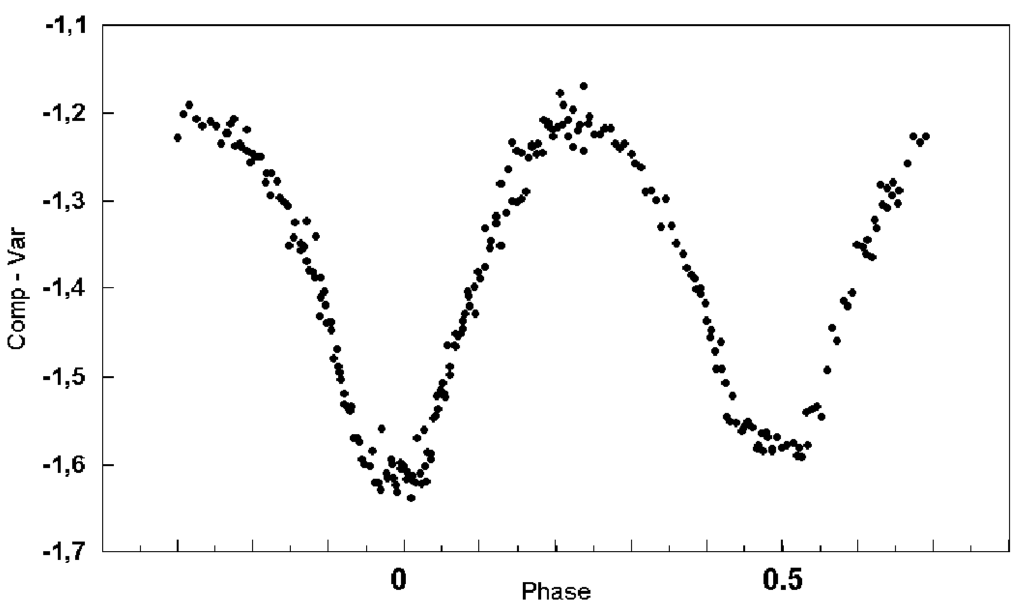

Figure 1. Differential V light curve of V1542 Aql measured in July 2001

Detector:	W. Quester: ST-7E camera; K. Bernhard: Starlight Xpress SX camera

Filter(s):	W. Quester: Bessel V; K. Bernhard: None

Comparison star(s):	GSC 1057.01223, $V \approx 10\overset{\text{m}}{.}4$

Check star(s):	GSC 1057.01437, GSC 1057.01527

Transformed to a standard system:	No

Availability of the data:

Upon request

Type of variability:	W UMa

Remarks:

V1542 Aql was discovered by Bernhard (1999) as a variable star. Bernhard and Lloyd (1999) published possible light curves and results of a period search. They concluded that the star either is a β Cep-, δ Sct- or a W UMa-type variable with four possible periods in the range from 0.172675 to 0.417570 days.

W. Quester observed V1542 Aql during 4 nights in July 2001. The rms error of single observations is $\pm 0\overset{\text{m}}{.}02$. The light curve, folded with the period given below, shows variations of a W UMa-type eclipsing variable (Figure 1).

The following times of minima were observed (HJD 2400000 +):

minimum time	type	observer	minimum time	type	observer
51065.388	s	Bernhard	52113.3933(07)	p	Quester
51080.405	p	Bernhard	52113.6000(15)	s	Quester
51103.378	p	Bernhard	52115.4825(07)	p	Quester
51111.3146(10)	p	Bernhard	52116.5270(05)	s	Quester
52112.5593(10)	p	Quester			

Figures in brackets denote rms errors in units of the last decimal, p and s denote primary and secondary minima. The uncertainty of Bernhard's first three minima may be around ± 0.01 day; these minimum times are based on only a few observations during each night. They were given lower weight in the calculation of the period. Resulting elements of the light variations are:

$$\begin{array}{rl} \text{Min p} = \text{HJD } 2452112.1411 + 0\overset{\text{d}}{.}4175361 \times E. \\ \pm 16 \qquad\qquad\quad \pm 13 \end{array} \tag{1}$$

Acknowledgements:

This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France.

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Bernhard, K., Lloyd. C., 1999, *IBVS*, No. 4685

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GSC 8527-373: A MULTIMODE DELTA SCUTI STAR

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The variability of GSC 8527-373, an approx. 12.5-mag star was discovered by Rea (2001) while monitoring the near-by CV star TW Pictoris. On the basis of the period ($0\overset{d}{.}080$) and amplitude ($0\overset{m}{.}2$) of the star's light variation the object was classified as a probable δ Scuti star. Since the variable has been thoroughly observed, it prompted us to rediscuss the observations and to look for further frequencies.

The original observations were made with an 0.35-m Schmidt–Cassegrain telescope and a CCD detector without using any filter, thus no colour information was obtained and no utilizable information was available from other sources either for this object. On the other hand the lack of filters may result in severe zero point shifts from night to night because of the colour dependence of atmospheric transparency. The observations have been obtained on 14 nights during two months: December 6, 7, 9, 12, 13, 21, 26, 2000, January 3, 13, 17, 26, 29, 31 and February 1, 2001.

Before the analysis heliocentric corrections were applied to the "raw" data and then, in order to decrease the scatter, the observations were binned in groups of three. Multifrequency analysis was performed with the MUFRAN (MUltiFRequency ANalysis) program package (Kolláth, 1990). MUFRAN is a collection of methods for period determination, sine fitting for observational data and graphics routines for visualization of the results.

The first, rather superficial frequency analysis clearly showed a high peak at $f_1 =$ 12.5521 c/d, the main frequency of the star. After prewhitening with the frequencies f_1, $f_2 = 2f_1$ and $f_3 = 3f_1$ the residual spectrum seemed to be very noisy. Our suspicion was that it might be the result of the defectiveness of the data. Therefore the data sets of different nights were carefully scrutinized and it turned out that the scatter of the observations were excessively large on the nights 12, 13 December, 2000 and 29 January, 2001. These observations were left out of consideration in the final analysis. (If we took into account the less noisy data of these nights our final results did not change.)

Fig. 1 shows the spectral window and Fig. 2 presents the Fourier amplitude spectrum of the data of 11 nights. The frequency 12.5521 c/d and its multiples are present, and after prewhitening with them (Fig. 3), a further frequency $f_4 = 18.87660$ can be deduced. The results of the least-squares solution with these frequencies are given in Table 1. The residual is $0\overset{m}{.}013$ which seems to be slightly high since the error of the binned observations is around $0\overset{m}{.}005$.

After removing the frequencies f_1, $f_2 = 2f_1$, $f_3 = 3f_1$ and f_4, the remaining spectrum is shown in Fig. 4. The high peaks at the short frequency end refer to serious zero point shifts from night to night. Although real frequencies may exist on the short frequency ($f \leq 1$ c/d) domain (see e.g. Paparó et al. 1996), in the present case the previous explanation seems to be valid. Probably other frequencies ($f_5 = 10.3658$ c/d, $a_5 = 0\overset{\mathrm{m}}{.}003$; $f_6 = 18.6727$ c/d, $a_6 = 0\overset{\mathrm{m}}{.}003$) are also present, but the available observational material does not allow further discussion and conclusion.

The asymmetric light-curve ($f_2 = 2f_1$ and $f_3 = 3f_1$ are also present) and the low amplitude ratio $a_4/a_1 = 0.072$ make the object a very interesting δ Scuti star. The high amplitude oscillation (with the frequency f_1) may be identified as the fundamental radial mode, and the frequency f_4 (and possible other frequencies) as non-radial mode(s).

According to its behaviour the star resembles the unique high-amplitude δ Scuti star AN Lyncis (Rodríguez et al. 1997) in many respects (e.g. the amplitude ratio of the non-radial and radial oscillation or the frequency distribution).

The star is certainly a good target for further investigation.

Table 1: Least-squares solution

	frequency (d^{-1})	amplitude (mag)	phase (rad)
f_1	12.55213	0.069	0.56
$f_2 = 2f_1$	25.10426	0.010	2.71
$f_3 = 3f_1$	37.65639	0.002	0.76
f_4	18.87660	0.005	5.63

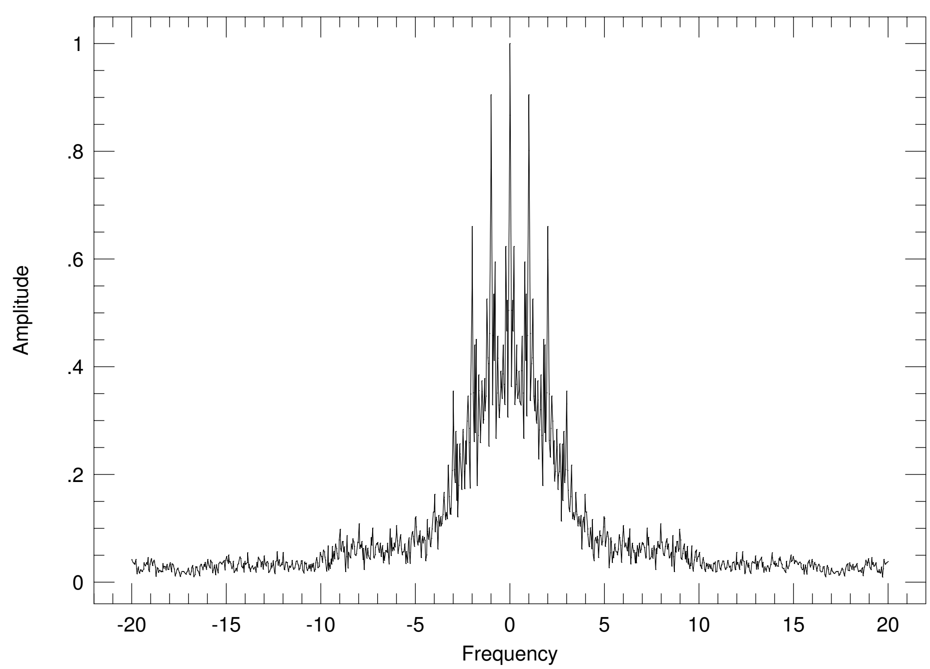

Figure 1. Spectral window

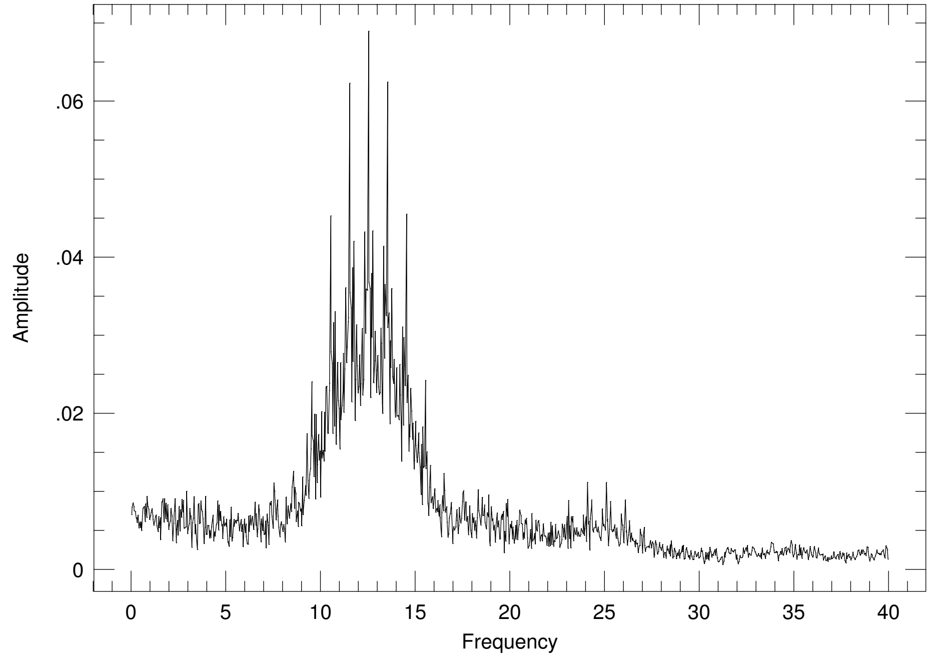

Figure 2. Amplitude spectrum of the binned observations of 11 nights

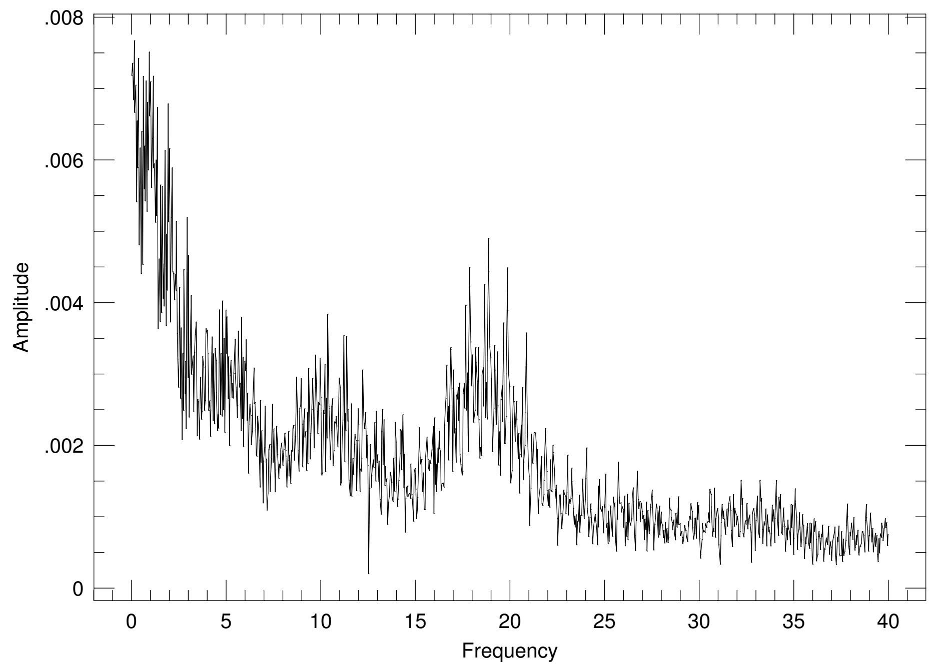

Figure 3. Amplitude spectrum of the binned observations of 11 nights after removing the frequencies $f_1,\ f_2 = 2f_1,\ f_3 = 3f_1$

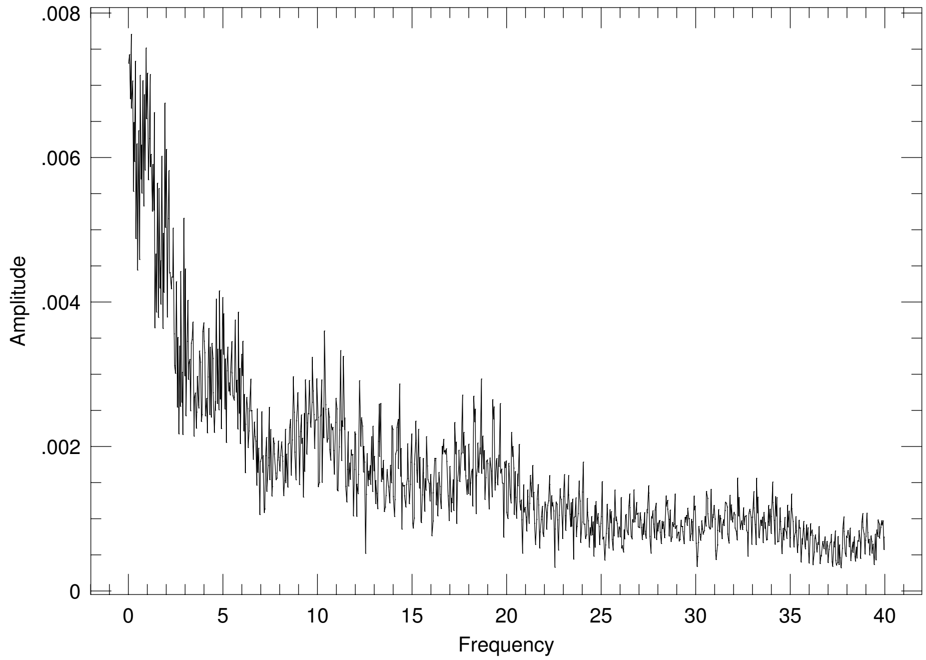

Figure 4. Amplitude spectrum after removing the frequencies f_1, $f_2 = 2f_1$, $f_3 = 3f_1$ and f_4

Acknowledgement. This work was supported by the Hungarian Research Grant OTKA T-030955.

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AUTOCORRELATION ANALYSIS OF TWO PULSATING RED GIANTS

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About 10 per cent of the naked-eye stars are pulsating red giants (PRGs), with amplitudes ranging from 0.01 to 10 magnitudes. The first PRG — Mira — was discovered over 400 years ago. Small-amplitude PRGs (SAPRGs), with amplitudes of 0.1 to 1 magnitude, and with early M spectral type, were surveyed by Stebbins & Huffer (1930). In past studies (e.g. Percy et al. 1996, Percy et al. 2001a,b), we found that autocorrelation analysis was a useful adjunct to light curves and Fourier analysis for determining the periods of these complex stars. It determines characteristic time scales by examining the cycle-to-cycle behaviour of the star, averaged over the dataset. The version of the autocorrelation method that we use (written by Matt Szczesny and Adrien Desjardins, and described by Percy & Sen 1991) is very simple: for each pair of measurements, the difference in magnitude is plotted against the difference in time, divided into appropriate "bins"; this "autocorrelation diagram" shows minima at integral multiples of the characteristic time scale. Each of the minima can be used to estimate the characteristic time scale. The height of the maxima is related to the amplitude of the variations; the height of the minima, above the zero point, is related to the average error of the measurements, and to the degree of irregularity of the variations; if the variability is irregular, then the minima do not persist with increasing Δt. Distortions or unequal depths of the minima may indicate the presence of multiple periods. Our algorithm is similar to the elegant "variogram" technique described by Eyer & Genton (1999).

Another form of autocorrelation analysis was published by Burki et al. (1978): the data in the light curve are moved sideways in time, and the scatter is assessed; when the shift is equal to the characteristic time scale (or an integral multiple thereof), then the fit is best. The purpose of this paper is to demonstrate the use of this second algorithm on two PRGs — one poorly-studied, and the other newly-discovered. Their light curves are shown in Figures 1 and 3. Figures 2 and 4 illustrate this algorithm; the horizontal axis is the sideways shift, in days; the vertical axis is a measure of the goodness of fit (lower θ indicates a better fit).

SX UMi (HD 126409, HIP 70245, SpT M) was initially observed by chance by two of us (JMGF & EGM) as part of another program, using a Starlight Xpress CCD camera with a Sony ICX027B chip and a Johnson V filter on two 6-cm refracting finder telescopes at Mollet and Esteve Duran Observatories. The Esteve Duran data were adjusted

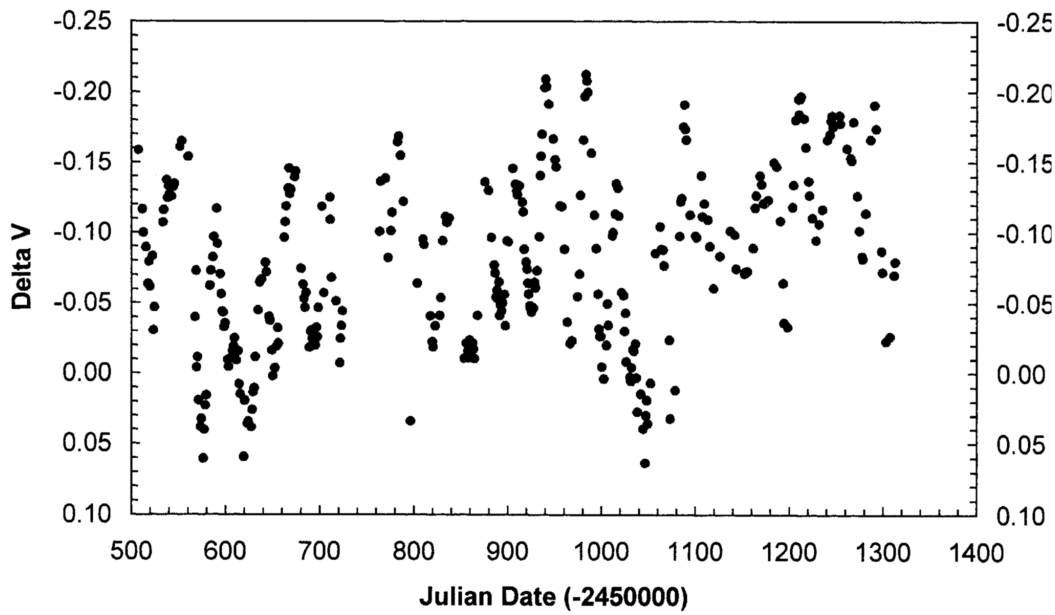

Figure 1. Differential V light curve of SX UMi, relative to HD 126048 ($V = 8.21$)

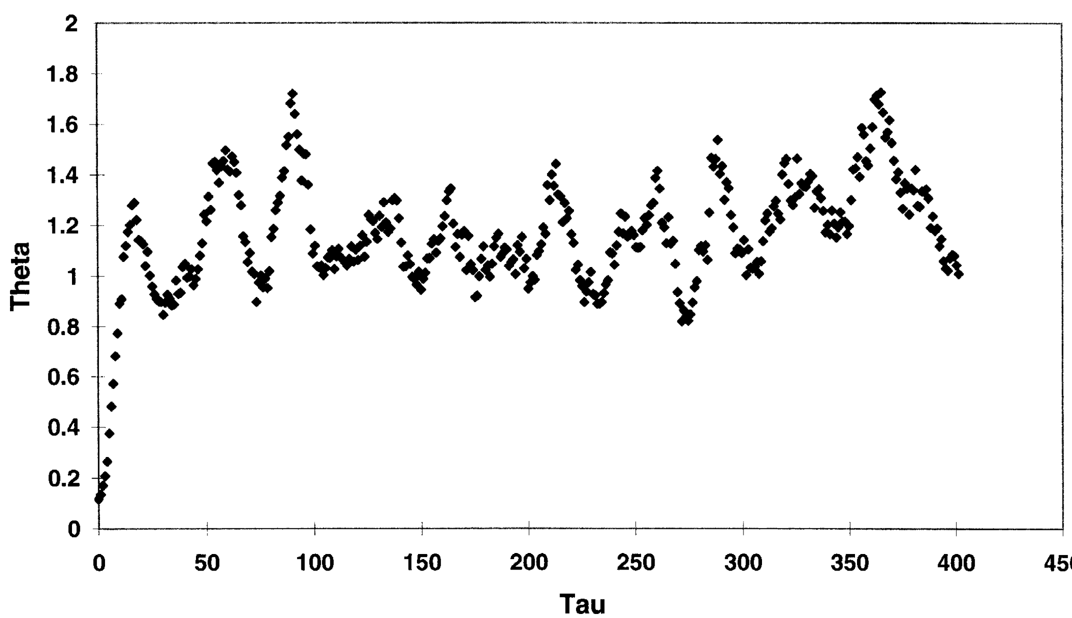

Figure 2. Autocorrelation diagram for the data in Figure 1

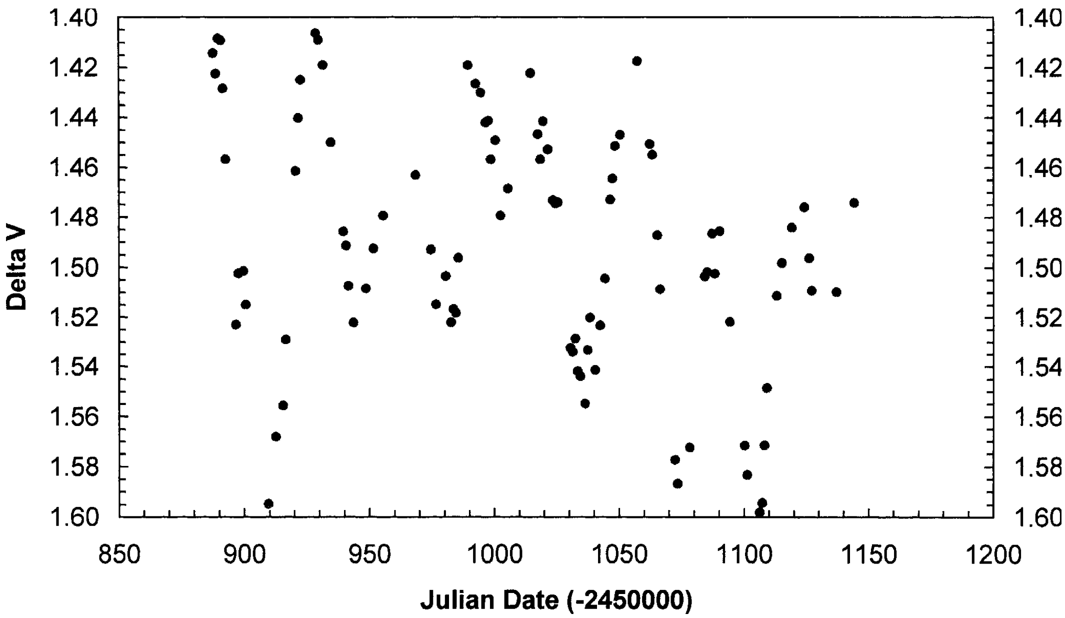

Figure 3. Differential V light curve of HD 190152, relative to HD 190323 ($V = 6.83$)

to match the Mollet data. In subsequent seasons, data were obtained with an 8-cm refractor at Mollet Observatory; no adjustment was necessary for these data. The comparison star was HD 126048 (HIP 70059, SpT K2) for which Perryman et al. (1997) give $V = 8.21$. The check star was HD 125917 (HIP 70006, SpT A3). Although HD 126048 is NSV 06640, Perryman et al. (1997) do not report any variability; the standard deviation is 0.013 (consistent with non-variability in a star of this magnitude); the maxima and minima are 8.35 and 8.39, respectively. Furthermore, our 335 measurements of HD 126048 relative to HD 125917 between JD 2450507 and 2451312 give a mean of +0.013 with a standard deviation of 0.0097, which is consistent with the observational error. We conclude that NSV 06640 was non-variable during the times that we and *Hipparcos* observed it. Synthetic aperture differential photometry was carried out. No correction for differential extinction was necessary, since the comparison stars were within $36'$ of the variable.

HD 190152 (BD+15° 4029, GSC 01617-02068, PPM 137505, SAO 105602, not in the *Hipparcos* catalogue, SpT M) is a previously-unknown variable which was also observed by chance by two of us (JMGF & EGM) as part of another program, using an 8-cm refractor at Mollet Observatory, and the same CCD camera and reduction techniques. The comparison star was HD 190323 (HIP 98788, SpT F8), for which Perryman et al. (1997) give $V = 6.83$, and the check star was HD 190067 (HIP 98677, SpT G5).

Figure 1 shows the differential V light curve of SX UMi, relative to HD 126048 ($V = 8.21$). The mean V is about 8.1. Semi-regular variations, with a cycle-count period of about 35 days and a total range of 0.27 magnitude, are apparent, as are long-term variations in amplitude and mean magnitude. Figure 2 shows the autocorrelation diagram of the data, using the Burki et al. (1978) algorithm. On the horizontal axis, τ is the sideways shift in time; on the vertical axis, θ is the goodness of fit (lower θ indicates better fit). The first two minima give a period of about 38 days, but the shallowness and the distorted appearance of the first and third minima suggest that a second period may also be present. Using all undistorted minima gives a period of 37 ± 1 days. The same data were used as a test of wavelet analysis of SAPRGs (Percy & Kastrukoff 2001), and

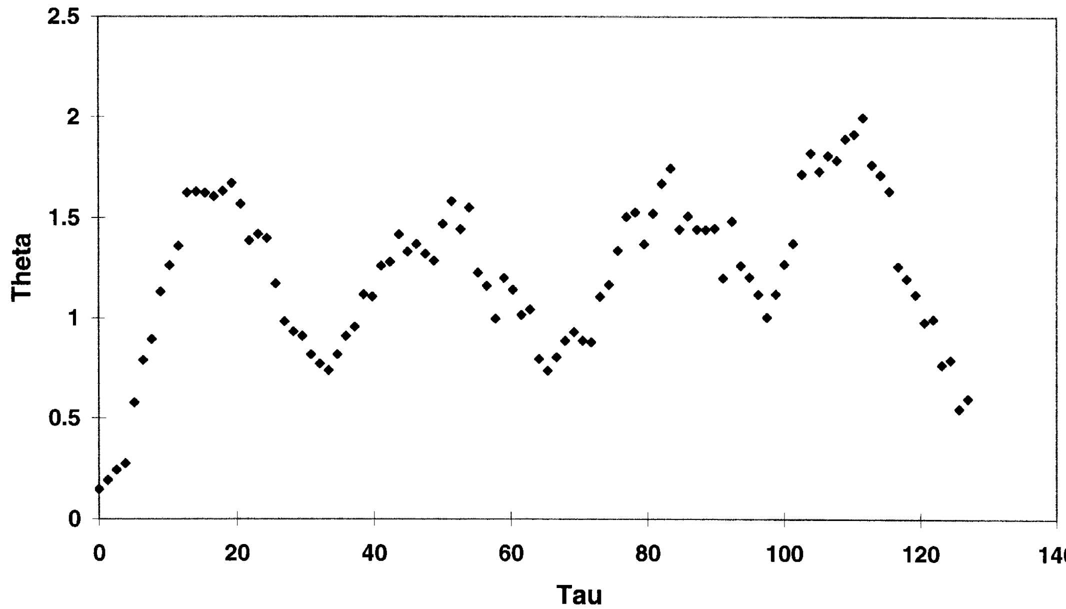

Figure 4. Autocorrelation diagram for the data in Figure 3

gave a mean period of 38 days.

Figure 3 shows the differential V light curve of HD 190152, relative to HD 190323 (V = 6.83). The mean V is about 8.3. Semi-regular variations, with a cycle-count period of 34 days and a total range of 0.2 magnitude, are apparent. Figure 4 shows the autocorrelation diagram of the data in Figure 3, using the Burki et al. (1978) algorithm. The four distinct minima give a period of 32 ± 1 days for this previously-unknown variable.

We conclude that the Burki et al. (1978) algorithm can be useful for autocorrelation analysis of small-amplitude pulsating red giants. We report period determinations, using this algorithm, for SX UMi and HD 190152 — a newly discovered variable.

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USNO-A2.0 0825-15411768: A NEW MIRA IN AQUILA

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The University of Illinois at Urbana-Champaigne's *Stardial* instrument is an autonomous drift-scan CCD camera mounted on the roof of that institution's Astronomy building (McCullough and Thakkar 1997). Consisting of a Kodak KAF400 CCD with a Nikon $f/1.4$ 50-mm focal length 35-mm format camera lens stopped to $f/2.0$, the instrument records nightly 8×5 degree images of a band of sky centered on -4 degrees declination. A broadband red-infrared filter (RG-1, passband 600 nm and longer) is employed between the lens and the CCD. A polynomial fit to the background light of each image is subtracted, and the images are immediately made available on the *Stardial* WWW site (http://www.astro.uiuc.edu/stardial/) in both FITS and JPEG format.

While blinking *Stardial* images of an area in Aquila, a star near R.A. $19^h20^m35^s$, Dec. $-03°57'50''$ (J2000) was observed to vary in brightness. A check of the GCVS (Kholopov et al. 1998) revealed no known variable star at or near that position, however the TASS tenxcat (Richmond et al. 2000) contained a series of Johnson V-band observations associated with the star GSC 5138-0446 (USNO magnitudes $m_B = 13.1$, $m_R = 11.6$, position R.A. $19^h20^m36\overset{s}{.}51$, Decl. $-03°58'18\overset{''}{.}9$, J2000 from GSC-ACT via Visier) that showed variability between magnitude 11.4 and 12.0. Viewing the area using the *Aladin* interactive sky atlas revealed another TASS detection (TASS J192035.3-035756) quite near the first – and the two sources appeared to vary in phase with each other. The second source was apparently associated with another red star, USNO-A2.0 0825-15411768 (USNO2 magnitudes $m_B = 14.9$, $m_R = 11.9$, J2000 position R.A. $19^h20^m35\overset{s}{.}029$, Dec. $-03°57'50\overset{''}{.}85$). Which star was the variable?

The TASS Mark III cameras have 13.4 arcseconds/pixel resolution, and the FWHM of stellar images range from 2.5 to 4.0 pixels. The GSC star and the USNO star are separated by 36 arcseconds. Therefore, the two stars were frequently merged.

The necessary confirmation was found on Digitized Sky Survey (http://archive.stsci.edu/dss/) images of the area. First and second generation red images of the area are presented in Figure 1. Comparing the two images, taken nearly 4 years apart, USNO-A2.0 0825-15411768 (indicated by tick marks in the left-hand, first generation image) is clearly the variable. For field identification, three prominent stars are identified on the right-hand, second generation image.

With the variable identified, all available *Stardial* images of the region were analyzed. 293 images covering portions of six observing seasons 1996–2001 were found suitable for differential photometry. A comparison star, SAO 143290, and a check star, SAO 143252, were chosen, and differential magnitudes were extracted from each image. As the *Stardial*

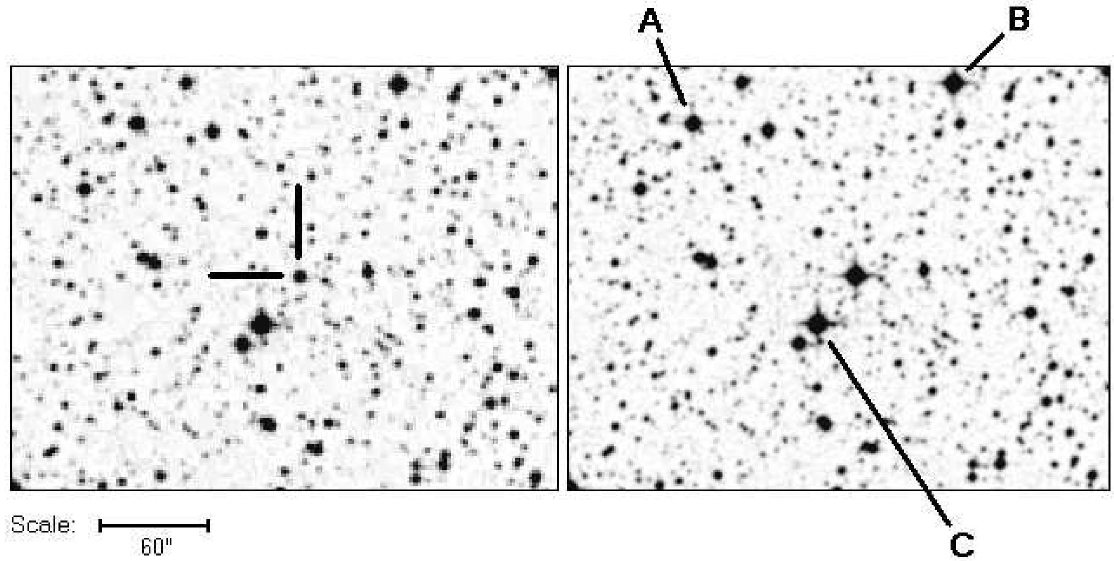

Figure 1. Comparison of Digital Sky Survey red plates of USNO-A2.0 0825-15411768. Tick marks on the left image indicate the variable. Three field stars are identified on the right image: A = GSC 5138-0815, B = GSC 5138-0058, C = GSC 5138-0446

images have a scale of approximately 35 arcseconds per pixel, over double that of the TASS Mark III cameras, the variable and GSC 5138-0446 are certainly merged in *Stardial* images. The contribution of GSC 5138-0446 to the total light of the pair, calculated from its red plate magnitude of 11.6, was subtracted from each observation. The results, along with 26 TASS I-band observations (converted to differential magnitudes) that are unambiguously associated with USNO-A2.0 0825-15411768 are plotted in Figure 2 and given in the electronic table 5164-t1.txt.

Regular variations of about 2.2 magnitudes in amplitude are seen. At first glance, the low amplitude would seem to be cause to classify this star as SRa; however the combination of the KAF400 CCD and RG-1 filter minimizes the effect of "amplitude excess" caused by TiO absorption bands (Celis 1978). Though we lack unambiguous V-band data, the visual amplitude is probably at least 3 magnitudes. TASS data show that $V-I$ near maximum light is 3.6 magnitudes, indicating a spectral type of M4-5 and an effective temperature of 3000 K (Zombeck 1990). The star is therefore classified as a Mira-type variable.

Infrared data from the IRAS Point Source Catalog support a conclusion that this star is likely a mass-losing AGB variable. USNO-A2.0 0825-15411768 is located within the uncertainty ellipse of IRAS 19179-0403. The star's average I-band flux, calculated from TASS data, when compared to the IRAS 12 and 25 micron infrared fluxes (Table 1) demonstrate an infrared excess consistent with a circumstellar dust shell as observed in other stars of this type (Little-Marenin and Little 1997).

Three maxima, at JD 2,450,325; 2,450,970 and 2,451,412 are well observed. A simple graphical solution (Richter et al. 1985, p. 16) yielded a best-fit period of 217.2 days. With only three maxima to work from, this period must be regarded as preliminary in nature. Initial elements for USNO-A2.0 0825-15411768 are thus:

$$\mathrm{JD}_{\mathrm{max}} = 2450323.4 + 217.2 \times E.$$

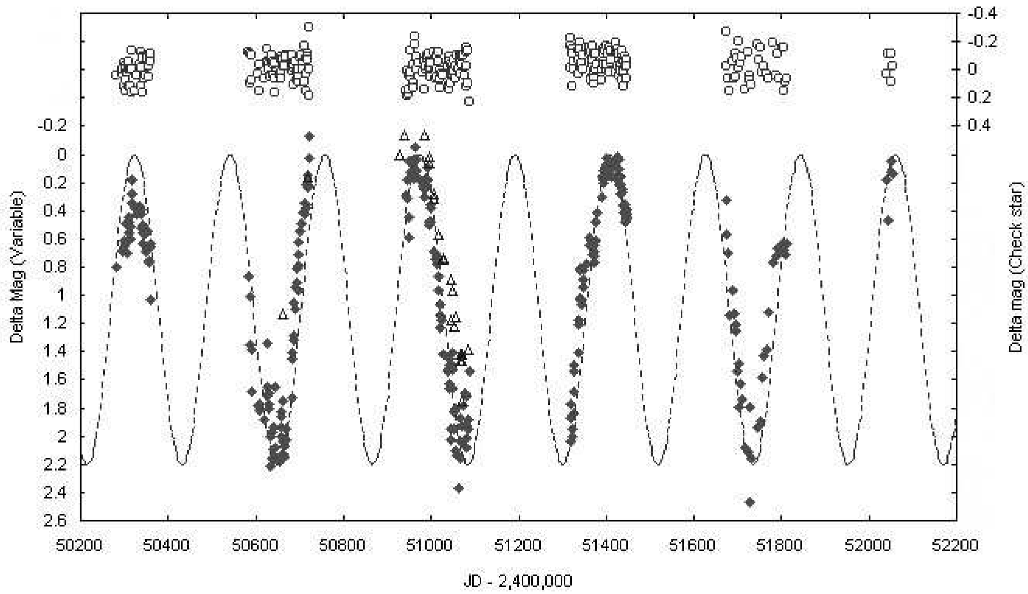

Figure 2. Light Curve of USNO-A2.0 0825-15411768. Filled diamonds represent the variable, open triangles are TASS Mark III *I*-band data, open circles represent the check star, and the dashed curve is computed from elements given in the text

Table 1: Infrared fluxes for USNO-A2.0 0825-15411768

λ (microns)	Flux (Jy)
0.79	1.71
12	1.63 $\pm$0.1
25	0.698 $\pm$0.01

The above elements may be affected slightly by infrared phase lag due to the combination of filter and CCD used. Maximum light of Miras in the infrared typically occurs near visual phase 0.1 to 0.2 (Pettit and Nicholson 1933; Lockwood and Wing 1971).

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This research has made use of the VizieR catalogue access tool and the Aladin interactive sky atlas, CDS, Strasbourg, France, and NASA's Astrophysics Data System Bibliographic Services.

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LOST HARVARD VARIABLES IN SAGITTARIUS, SCUTUM, AND SCORPIUS RECOVERED ON NANTUCKET AND MOSCOW PLATES

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For the reasons discussed by Hazen & Samus (1999), it is important to recover variables lacking finding charts. This problem can be most effectively solved using the Harvard plate collection, especially because many stars with no finding charts ever published were first discovered at Harvard Observatory. However, much can be done using plate collections of other observatories. For several years, we successfully use the plate collection of the Maria Mitchell Observatory (MMO) to recover "lost" variables. The results of 1998 were presented in Tam & Samus (2000); those of 1999, in Samus et al. (1999); those of 2000, in Samus et al. (2001). Plates of the Moscow collection are also being used for this purpose for many years.

In 2001 we have successfully recovered 10 "lost" Harvard variable stars on Nantucket and Moscow plates. The main results are presented in Tables 1 and 2. The columns of Table 1 contain: GCVS name; preliminary Harvard designation (HV – Harvard Variable); GSC number (if available); the star's right ascension and declination (equinox 2000.0); source of coordinates (A2.0 means the US Naval Observatory A2.0 catalog, Monet et al. 1998; DSS means coordinates measured by us on a DSS image, relative to several reference stars with coordinates from the USNO A2.0 catalog). For the two stars lacking GSC or USNO A2.0 catalog identifications, we present finding charts based on DSS images. The columns of Table 2 contain: GCVS name; the star's type found in our study; light elements (epoch and period) if they could be derived from our data (epochs refer to minimum light for the probable eclipsing variable and to maximum light for pulsating variables). Remarks on individual stars follow the Tables.

Thanks are due to Vladimir Strelnitski for his help and attention during the Nantucket part of this investigation. We are grateful to Sergei Antipin for his assistance during the preparation of the manuscript. This study was supported, in part, by grants from the NSF/REU (AST-0097694) and from Russian Foundation for Basic Research (99-02-16333).

Table 1: Identifications and coordinates

Name	HV	GSC	$\alpha_{2000.0}$	$\delta_{2000.0}$	Source
AB Sgr	3649		$19^h01^m54\overset{s}{.}75$	$-12°56'09\overset{''}{.}7$	A2.0
BF Sgr	3652		19 04 56.35	−11 58 50.1	A2.0
CN Sgr	3758		19 02 53.30	−13 11 46.3	DSS
AM Sco	1014		16 07 08.55	−23 40 11.3	A2.0
AO Sco	1052	6213.0567	16 15 02.38	−21 45 27.6	GSC
AQ Sco	1061	6794.0110	16 20 34.67	−23 14 33.4	GSC
AS Sco	1065		16 22 36.12	−20 58 32.3	A2.0
TU Sct	3645		18 57 44.92	−12 55 26.5	A2.0
UV Sct	3642	5714.0420	18 55 23.80	−12 46 56.6	GSC
AM Sct	3830		18 52 02.50	−08 31 17.8	DSS

Table 2: Types and light elements

Name	Type & epoch	JD 24...	Period
AB Sgr	SR	44491	260^d:
BF Sgr	SR:	29430	
CN Sgr	M	44817	$276\overset{d}{.}4$
AM Sco	IS:		
AO Sco	EB:	40000.44	
AQ Sco	RRAB	40706.48	$0\overset{d}{.}482367$
AS Sco	?		
TU Sct	SRA	43016	$128\overset{d}{.}6$
UV Sct	SR	42979	102^d
AM Sct	M:	48082	$435\overset{d}{.}3$

Notes on individual stars

AB Sgr Twelve maxima or brightenings (Table 3) were observed on Nantucket plates. Their presentation with the period in Table 2 is not quite satisfactory, the star may belong to SRB variables.

Table 3: Maxima and brightenings of AB Sgr

Max JD 24...	Max JD 24...	Max JD 24...
25436::	29435:	42930:
26206::	29908	44491
28020	33593::	48151:
28257::	35690:	48460::

BF Sgr The star is double, the northern component of the pair varies. Its position, measured using DSS images, confirms the identification with the single A2.0 catalog object present in this region of the sky. The star is just outside the error ellipse of IRAS PSC 19021–1203 but nevertheless the IRAS object can be a correct identification. The maximum in Table 2 is based on two Nantucket plates; the star was faint on JD 2428400.

CN Sgr The period in Table 2 is from Harwood (1931). On Nantucket plates, the star was found bright on JD 2444817 and faint on JD 2445231.

AM Sco Leavitt (1904) considered the star a possible Mira-type variable. It is in the error ellipse of IRAS PSC 16041–2332. Nevertheless, the star is not red in the A2.0 catalog ($b - r = 1.2$) and does not seem red on DSS images. Moscow plates show strong brightness variations within several days. No reliable period value could be found.

AO Sco A period value of $9\overset{d}{.}42669$ is possible from our limited data, based on 45 Moscow plates.

AQ Sco The star was initially thought to be a slow variable (Leavitt, 1904), then a possible Orion variable (Himpel, 1944). We now suggest to reclassify it again as an RRab star. The preliminary light elements of Table 2 were found from 48 observations on Moscow plates (JD 2437074–2447347).

AS Sco Our data (based on Moscow plates) are not sufficient to classify this star, suspected by Leavitt (1904) to be a short-period variable.

TU Sct The new elements (Table 2) satisfactorily represent epochs of 22 maxima (JD 2414210–2445231, many of them uncertain) found using Nantucket plates (18 maxima or brightenings in Table 4) or available in the literature (Harwood, 1962; 9 maxima, 5 of them also represented in our observations).

Table 4: Maxima and brightenings of TU Sct

Max JD 24...	Max JD 24...	Max JD 24...
25143	27980:	32729:
25414:	28370:	33510:
26163:	29523:	33765:
26587:	29813	33900
27361:	29930	43016
27693	32082:	45231:

UV Sct This is IRAS PSC 18525–1250. The period in Table 2 is from Harwood

(1962); the maximum was derived from 8 Nantucket plates. The star was also bright on JD 2433186 and faint on JD 2433100.

AM Sct The new light elements (Table 2) represent 7 epochs of maxima found on Moscow plates (Table 5) and do not contradict the two old approximate epochs available in the literature (Cannon, 1924).

Table 5: Maxima of AM Sct

Max JD 24...	Max JD 24...	Max JD 24...
32848	39342+	48096
37198	41160−	
38968	41566+	

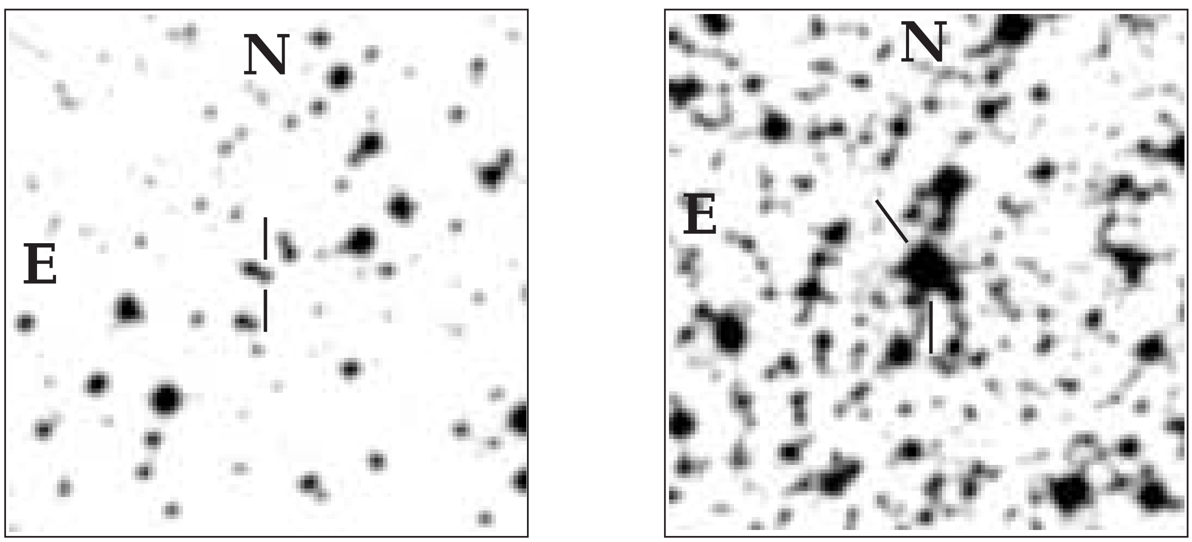

Figure 1. The finding charts for CN Sgr (left) and AM Sct (right), from red-light images of the second Digitized Sky Survey. The side of each chart is 2′

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PHOTOMETRY OF STARS NEAR WZ Sge

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The dwarf nova WZ Sge goes into outburst every few decades, and erupted again during July 2001. This star has been extensively studied during outburst and quiescence. However, few reports that present calibrated magnitudes for nearby stars that can be used as comparison stars have been given. Krzeminski and Kraft (1964, KK) list the UBV magnitudes for three nearby stars. Those magnitudes have been adopted by most other researchers.

In addition, WZ Sge has a close, red companion. In the 1960's, this companion was only $7''$ west of the variable and made measurement of the variable itself during quiescence quite difficult. The proper motion of WZ Sge (Luyten 1969) has moved the dwarf nova further to the east, increasing the separation of the two stars to the current value of $10\overset{''}{.}9$. With CCD detectors, this separation is easily resolved if the seeing is relatively good and the pixel scale is such that several pixels fall between the two centroids. However, this pixel scale is not always available for amateur telescopes, and using unfiltered photometry, the light from the close companion starts to dominate once WZ Sge is fainter than about $V = 12$.

We have remeasured the KK comparison stars, along with many other fainter stars, to extend the wavelength range of the calibration to Cousins R and I and to provide an independent check on the KK published values at UBV. We have found some discrepancies and are presenting the new values in a timely fashion ahead of measures of WZ Sge itself in the hopes of providing improved calibration for other observers.

The 1.5-m telescope at CTIO, along with an RCA 31034A photomultiplier tube, $14''$ aperture and the same filters as discussed in Landolt (1992) were used to calibrate four bright comparison stars. A large number of standard stars, careful extinction determination, and the application of nonlinear transformation coefficients were used to obtain two measures of each star on three separate nights. These stars, along with WZ Sge and the close companion, are shown in Figure 1. The photometric measures of all comparison stars are given in Table 1, where the error in the last digit(s) is indicated in parenthesis.

The 1.0-m telescope at the USNO, Flagstaff Station was used with a SITe/Tektronix 1024×1024 CCD and $UBVR_cI_c$ filters to independently measure the four main comparison stars, along with many fainter stars. Data was taken on four mostly photometric nights. These measures are given in Henden (2001). A fainter extension, but only in B and V filters, is given in Henden and Honeycutt (1997). In addition, psf-fitting was performed on two nights during the recent outburst to obtain good magnitudes and positions of WZ

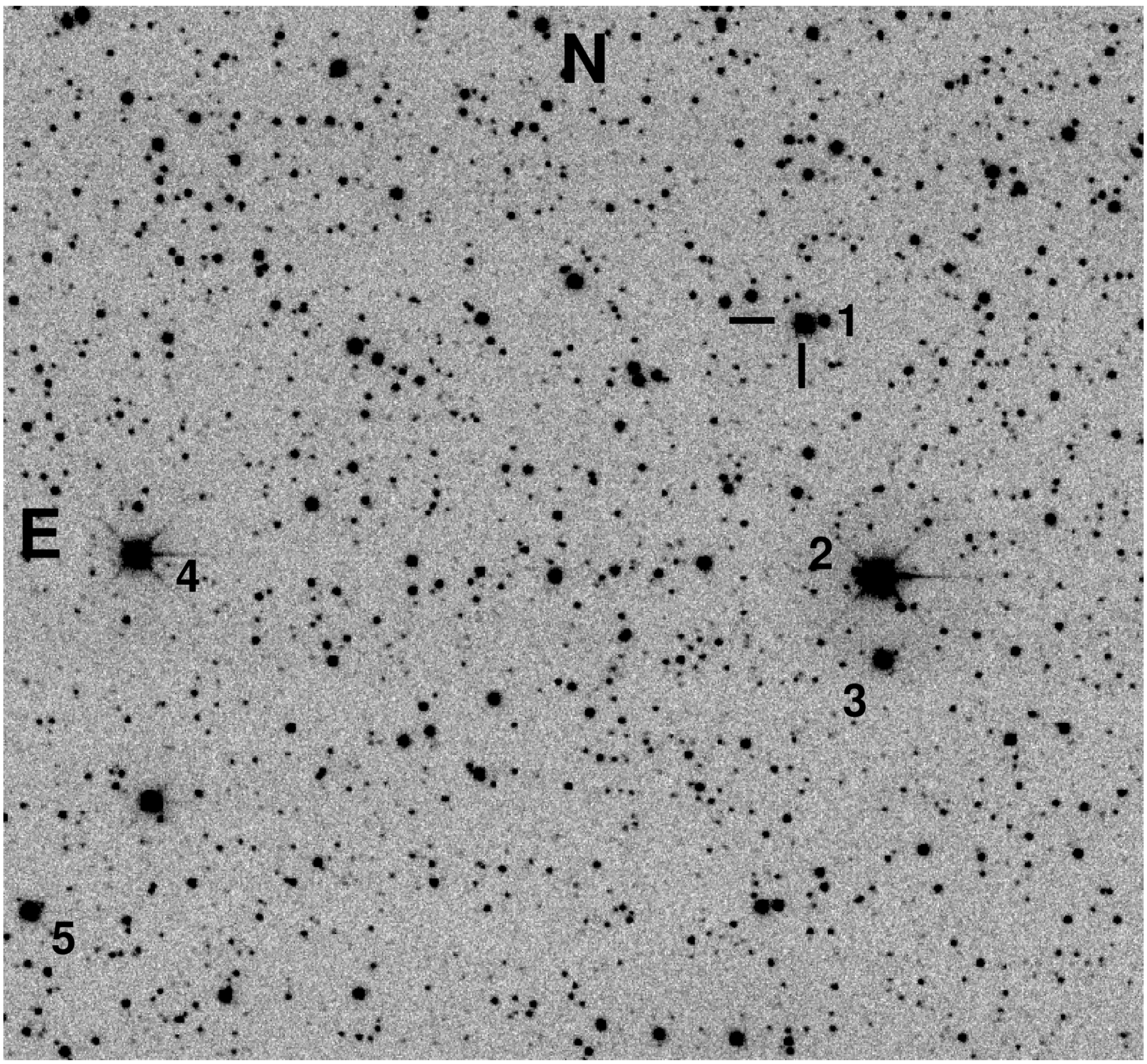

Figure 1. Combined outburst NOFS CCD V image of field. The field of view is $10' \times 10'$

Sge and of its close companion. The magnitude and colors of the companion, along with representative magnitude and colors of WZ Sge in outburst, are also given in Table 1. The photometric errors for the companion are largely due to the short exposure times used and the faintness of the companion with respect to WZ Sge at blue wavelengths. The measured positions for all stars are from the CCD images, are relative to USNO-A2.0, and have internal errors of 100 mas.

Table 1: Coordinates and Magnitudes

ID/KK	RA(J2000)	Dec(J2000)	V	$B-V$	$U-B$	$V-R$	$R-I$
WZ Sge	$20^h07^m36\overset{s}{.}53$	$+17°42'15\overset{''}{.}2$	8.646(5)	−0.078(5)	−0.781(5)	0.016(5)	0.020(5)
1	$20^h07^m35\overset{s}{.}77$	$+17°42'17\overset{''}{.}1$	13.888(18)	1.514(24)	1.587(68)	0.802(9)	0.687(8)
2/C	$20^h07^m33\overset{s}{.}74$	$+17°40'00\overset{''}{.}6$	8.737(5)	0.168(4)	0.136(6)	0.075(2)	0.078(3)
3	$20^h07^m33\overset{s}{.}56$	$+17°39'16\overset{''}{.}1$	11.755(5)	0.192(6)	0.150(5)	0.088(3)	0.113(7)
4/A	$20^h08^m01\overset{s}{.}45$	$+17°40'11\overset{''}{.}2$	9.686(5)	1.012(2)	0.780(7)	0.531(3)	0.488(4)
5/B	$20^h08^m05\overset{s}{.}42$	$+17°37'01\overset{''}{.}7$	11.770(3)	0.393(5)	0.207(7)	0.215(3)	0.210(5)

The colors for KK stars A, B, C agree between these new measures and the published values. However, the V magnitude differs in the sense that KK is always fainter than the new magnitudes, ranging from $0\overset{m}{.}02$ for star C to $0\overset{m}{.}07$ for star B.

As reported by KK, the companion was measured on one night by Olin Eggen on the 5-m Hale telescope. Its measured values were $V = 14.27$, $B - V = 1.49$, $U - B = 1.45$. These values differ considerably from the values shown in Table 1. Either the comparison star is variable, or the method used to separate WZ Sge and its companion with the photoelectric photometer on the 5-m telescope did not split the two stars cleanly.

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GSC 5002-0629: A NEW BRIGHT DOUBLE-MODE RR LYRAE VARIABLE

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The variability of GSC 5002-0629 was first announced by Henden and Stone (1998) who found it in the Sloan digital survey calibration fields. This star also received the denomination of FASTT1 0687 in the list of new Sloan variables. In a collaborative work between the US Naval Observatory Flagstaff Station, the Esteve Duran Observatory Foundation, and the Grup d'Estudis Astronomics, GSC 5002-0629 was included in a list of selected bright FASTT1 variable stars to confirm their variable nature and, if possible, characterise them.

Once the variability of this star was confirmed from Mollet Observatory and a tentative variable type assigned, GSC 5002-0629 was intensively observed for 35 nights, from 1 April 1997 to 22 January 1998 with the 0.6-m Cassegrain telescope at Esteve Duran Observatory in the V band, and the 1-m Ritchey–Chrétien telescope at the US Naval Observatory Flagstaff Station in the B, V, R_c, and I_c bands. A total of 1508 photometric datapoints were collected. Several stars in the field of GSC 5002-0629 were placed in the standard system by using Landolt (1992) standards. GSC 5002-0506 was used as primary comparison and GSC 5002-0636 as check star, but the latter could not be included in the CCD frames taken with the 1-m telescope and therefore this object could not be standardised. Table 1 lists the standard V magnitudes and color indices of comparison stars near the variable whereas Figure 1 shows the field of GSC 5002-0629.

Table 1

Star	GSC	V	$B-V$	$V-R$	$R-I$
A	5002-0506	11.503 ± 0.014	0.537 ± 0.006	0.336 ± 0.006	0.329 ± 0.005
B	5002-0525	13.528 ± 0.019	0.655 ± 0.015	0.390 ± 0.014	0.381 ± 0.015
C	5002-0566	12.936 ± 0.015	0.545 ± 0.011	0.339 ± 0.014	0.344 ± 0.012
D	5002-0650	13.550 ± 0.016	0.923 ± 0.012	0.543 ± 0.012	0.515 ± 0.014

Observations show that GSC 5002-0629 is a new field double-mode RR Lyr variable star. To date this is the seventh known RRd pulsator in the Milky Way field (Jerzykiewicz and Wenzel 1977; Clement et al. 1991; Garcia-Melendo and Clement 1997; Moskalik 2000; Clementini et al. 2000). GSC 5002-0629 is also particularly interesting because,

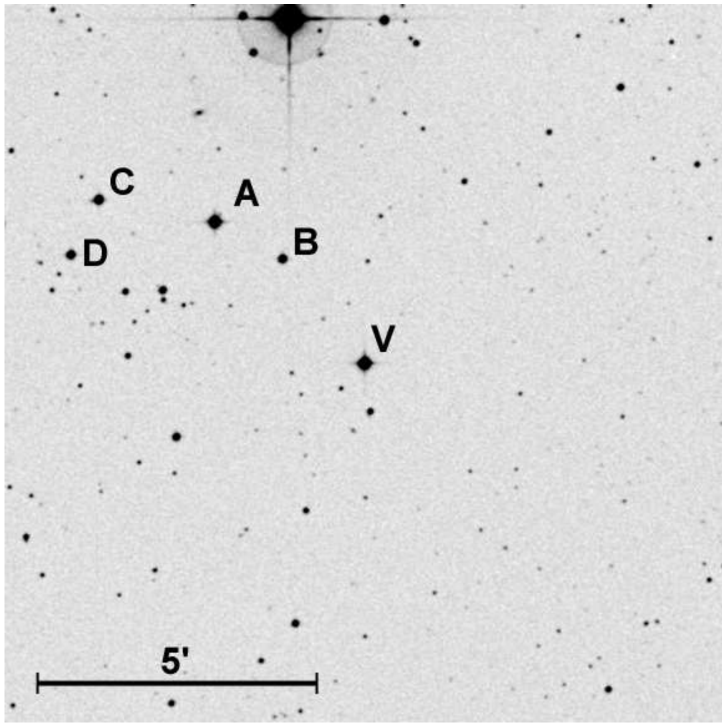

Figure 1. Field of GSC 5002-0629. See Table 1 to identify stars. V = GSC 5002-0629. Image retrieved using Aladin Previewer at Centre de Données astronomiques de Strasbourg, from the Science and Engineering Research Council at the Space Telescope Science Institute. North is on top

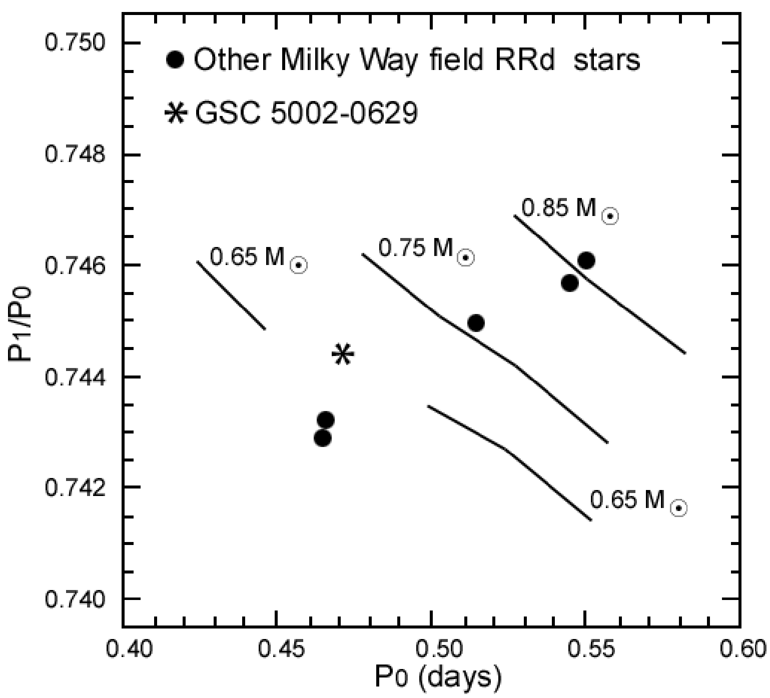

Figure 2. Position of GSC 5002-0629 on the Petersen diagram with pulsation models for 0.85, 0.75, and 0.65 solar masses adapted from Clementini et al. (2000). The other represented Milky Way field RRd stars are AQ Leo (Jerzykiewicz et al. 1982), VIII-10, VIII-58 (Clement et al. 1993), V2493 Oph (Garcia-Melendo and Clement 1997), and CU Com (Clementini et al. 2000)

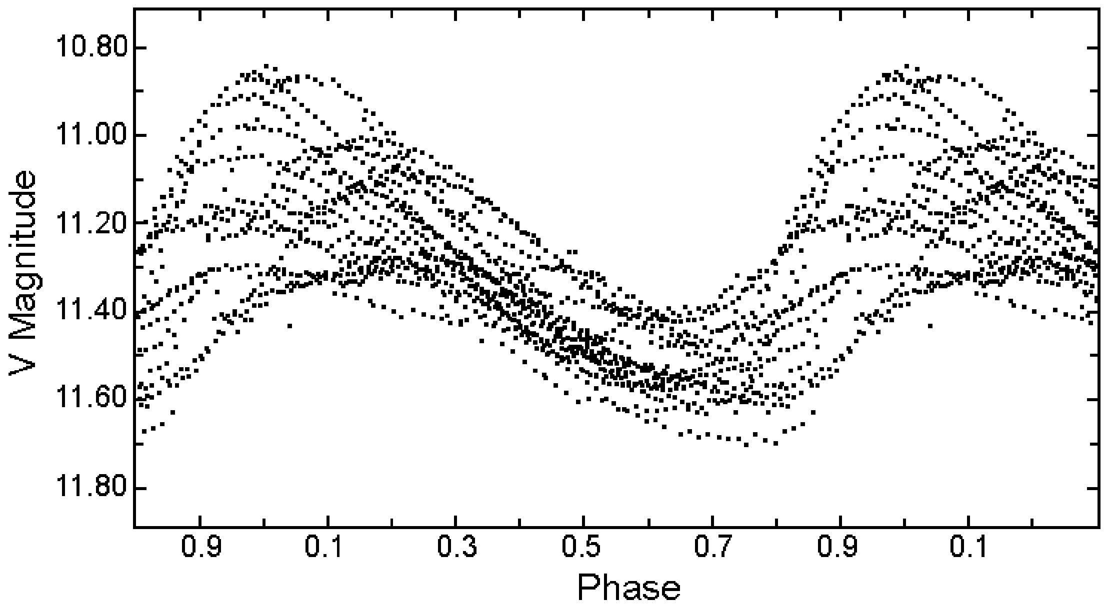

Figure 3. Light curve of GSC 5002-0629 folded according to P_1. The arbitrary HJD 2450548.664 date was taken as origin

with an average V magnitude of 11.32, it is the brightest of all known RRd variables to date. Therefore it will allow observers to obtain accurate spectroscopic data to study its metallicity. After performing a Fourier analysis following the same approach described by Garcia-Melendo and Clement (1997), it was found that this star pulsates with periods $P_0 = 0\overset{d}{.}47125$ and $P_1 = 0\overset{d}{.}35079$ with a P_1/P_0 ratio of 0.7444, a common value for double-mode RR Lyr stars. Table 2 summarizes all the relevant measured parameters for GSC 5002-0629. A Fourier decomposition of the light curve of this star also showed, as is typical among RRd pulsators, that the first overtone is the dominant mode of pulsation, in this case $A_1(V)/A_0(V) = 1.4$ ($A_0(V)$ and $A_1(V)$ are the amplitudes in the V band associated to the P_0 and P_1 components respectively). The P_0 and P_1/P_0 values place this star on the theoretical low-mass side of the Petersen diagram (Figure 2). Figure 3 shows the photometric data obtained in the V band folded according to P_1.

Table 2: Relevant data of GSC 5002-0629

P_1 (days)	0.35079 ± 0.00020
P_0 (days)	0.47125 ± 0.00020
P_1/P_0	0.7444
$\langle V \rangle$	$11\overset{m}{.}32$
$\langle B-V \rangle$	$0\overset{m}{.}38$
$\langle V-R \rangle$	$0\overset{m}{.}26$
$\langle R-I \rangle$	$0\overset{m}{.}29$
$V_{max} - V_{min}$	$0\overset{m}{.}86$
$A_1(V)$	$0\overset{m}{.}20$
$A_0(V)$	$0\overset{m}{.}14$

Acknowledgements. This work made use of the SIMBAD database operated by the CDS at Strasbourg, France.

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GSC 0752.2349 IS AN ECLIPSING BINARY OF W UMa TYPE

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Name of the object:
GSC 0752.2349

Equatorial coordinates:	**Equinox:**
R.A.= $06^h58^m10\overset{s}{.}8$ **DEC.=** $+10°13'58''$	2000

Observatory and telescope:
S. Kiyota: Private observatory, 25-cm Schmidt–Cassegrain telescope; K. Bernhard: Private observatory, 20-cm Schmidt–Cassegrain telescope; P. Frank: Private observatory, 30-cm flat-field camera

Detector:	S. Kiyota: Apogee AP-7 CCD camera; K. Bernhard: Starlight Xpress SX camera; P. Frank: OES-LcCCD11 camera

Filter(s):	S. Kiyota: Johnson-Cousins V; K. Bernhard: none; P. Frank: none

Comparison star(s):	K. Bernhard: GSC 0752.2661, $V \approx 12\overset{m}{.}6$

Check star(s):	K. Bernhard: GSC 0752.2295

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	W UMa

Remarks:

The variability of GSC 0752.2349 has been found as part of a programme to discover and classify new variables using CCD observations of selected fields on the edge of the northern Milky Way, during a survey phase in January-February 2000, for the programme see Bernhard & Lloyd 2000. Further observations were performed on 4 nights in March 2000 (S. Kiyota), on one night in April 2000 (P. Frank) and on 3 nights in March-April 2000 (K. Bernhard). This star has previously been referred to as Brh V37 (Bernhard 2000).

The ephemeris was calculated using the "Phase Dispersion Minimization" method. The light curve, reduced with the period given below, shows variations of a W UMa-type eclipsing binary.

$$\begin{array}{rl}\mathrm{Min\,I} = \mathrm{HJD}\ 2451621.072 + 0\overset{\mathrm{d}}{.}5263 \times E. & \\ \pm 5 \qquad\quad \pm 3 & \end{array} \qquad (1)$$

Acknowledgements:

This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France.

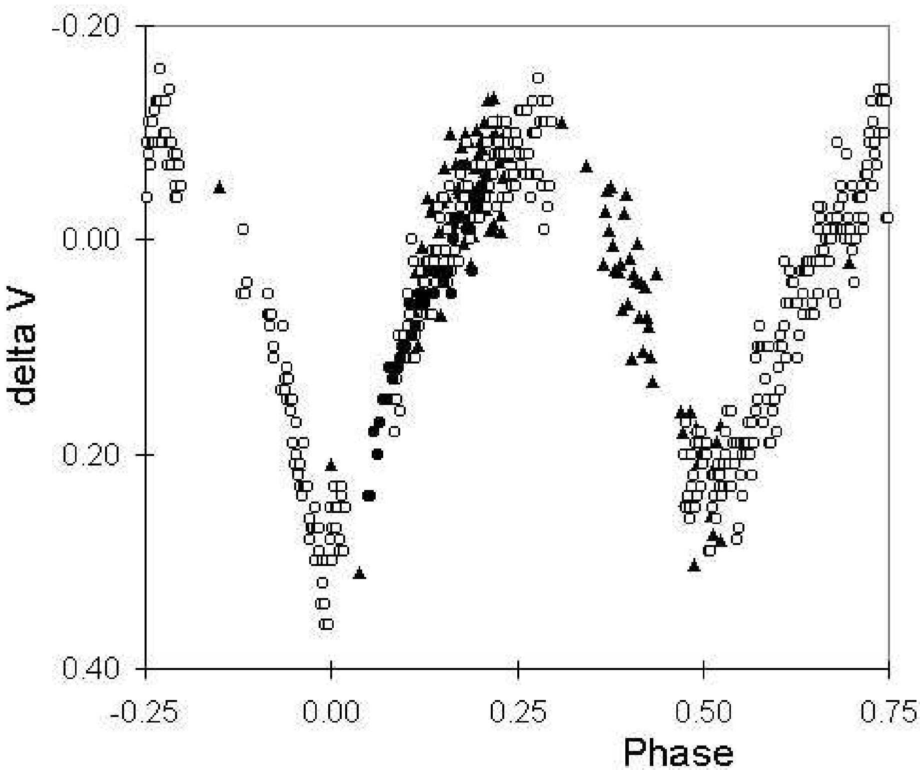

Figure 1. Differential light curve of GSC 0752.2349; filled triangles: K. Bernhard, filled circles: P. Frank, open circles: S. Kiyota

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1999 OBSERVATIONS OF THE SOLAR TYPE ECLIPSING BINARY, TY URSAE MAJORIS

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TY Ursae Majoris [GSC 3837-135, SVS 366, RA(2000) = $12^{\mathrm{h}}9^{\mathrm{m}}2\overset{\mathrm{s}}{.}656$, DEC(2000) = $56°01'53\overset{''}{.}54$] was observed as a part of our program to detect solar type, eclipsing binaries coming into contact through the use of precision multi-band photometry. Broglia & Conconi (1983) had modeled TY UMa in both near contact and a shallow contact configurations, so we added this binary to our list of program stars. TY UMa was discovered by Beljawsky (1933). Broglia & Conconi (1983) presented 2 complete light curves from 1981 and 1982 as well as a partial one from 1967. They found moderate asymmetries in the light curves and calculated the following light elements:

$$\text{J.D. Hel Min I} = 2439532\overset{\mathrm{d}}{.}4965 + 0.354538609 \times E. \tag{1}$$

Their Wilson Code contact solution gave a marginal fill-out of 12% and a mass ratio of 0.4. Similarly, their near contact solution gave a mass ratio of 0.42. Later, Lister et al. (2000) reported V and I light curves from 1993 observations. Lister et al.'s (2000) curves are similar in characteristics to the 1981 curves of Broglia & Conconi (1983). Their models, calculated with the LIGHT2 synthesis code gave a similar inclination and mass ratio with an unusually large fill-out, 27.5%. Such a rapid of change in the degree of contact is difficult to explain especially for a system there describe as undergoing thermal relaxation oscillations about shallow contact. We suggest that spot activity is played a role in their results. The present observations were taken with the 0.79-m Lowell telescope, Flagstaff, Arizona on April 9–11, 1999. Standard Johnson UBV filters were used in conjunction with a thermo-electrically cooled, blue-enhanced PMT. The comparison and check star are given as Comp, and Chk in Figure!1 along with the variable Var. Our photometry revealed that the comparison star [HD 105859, GSC 3837-122, $V = 10.226(11)$, $B - V = 0.609(13)$, $U - B = 0.085(14)$] is of spectral type G0V and the check star, [GSC 3837-157, $V = 9.085(20)$, $B - V = 0.286$, $U - B = 0.068(12)$] is of spectral type A9V. TY UMa, at phase zero had magnitudes $V = 12.077(19)$, $B - V = 0.627(21)$, and $U - B = 0.102(7)$. Here, standard errors accompany the values given in parentheses. All three stars show no evidence of reddening, but lie on the main sequence $U - B$ vs. $B - V$ color-color diagram. We took 666 individual observations in U,

Table 1: Epochs of minimum light of TY UMa

JD Hel. 2400000 +	Epoch	$(O-C)_1$	$(O-C)_2$	Source
40714.7018	−26735.5	−0.0037	0.0002	Walker
40714.8788	−26735.0	−0.0040	−0.0000	Walker
40717.7163	−26727.0	−0.0028	0.0011	Walker
40717.8951	−26726.5	−0.0013	0.0027	Walker
40718.7796	−26724.0	−0.0032	0.0008	Walker
41395.7701	−24814.5	−0.0117	−0.0002	Walker
41395.9483	−24814.0	−0.0107	0.0007	Walker
50193.5894	0.0	0.0109	0.0001	BAV 102
51278.8626(2)	3061.0	0.0293	−0.0041	PO
51279.7495(1)	3063.5	0.0299	−0.0036	PO
51279.9267(1)	3064.0	0.0298	−0.0036	PO
51280.8124(8)	3066.5	0.0291	−0.0055	PO

PO: Present Observations

671 in B, and 669 in V. Four mean epochs of minimum light were determined from two primary and two secondary eclipses using bisection of chords method. Observations taken in 5, 8, 11 and 12 of May 1970, and 19 March 1972 at the Naval Observatory, Flagstaff station by Walker, yielded nine additional timings of minimum light which we present here. Walker used the tracing paper method to find these. These precision epochs of minimum light are given in Table 1 along with the standard errors of the last digits in parentheses.

A linear ephemeris was calculated using 198 epochs of minimum light:

$$\text{J.D. Hel Min I} = 2450193\overset{\text{d}}{.}5785(50) + 0.35454257(26) \times E. \tag{2}$$

The residuals are shown in Figure 2 and as $(O-C)_1$ in Table 1. The residuals in Figure 2 show a continuous period increase.

Although a quadratic fit seems suggested by the curve, it did not represent the data well so a cubic was attempted. This ephemeris fits the residuals surprisingly well. Such a fit is shown in Figure 2 overlaying the O-C residuals. The cubic ephemeris is:

$$\begin{aligned} \text{J.D. Hel Min I} = 2450193\overset{\text{d}}{.}5893(16) + 0.35454911(33) \times E + \\ + 2.70(15) \times 10^{-10} \times E^2 + 1.74(17) \times 10^{-15} \times E^3. \end{aligned} \tag{3}$$

The residuals of this fit are shown in Table 1 as the $(O-C)_2$. Physically this could mean that there is an accelerating period increase. In the case of conservative mass transfer, this would be caused by a continuous but increasing mass flow from the smaller to the larger component of the binary. The UBV light curves and the $B-V$ and $U-B$ color curves of the variable are shown in Figure 3 as differential standard magnitudes (variable − comparison) versus phase. We note that a sinusoidal curve fits the data with an equally good fit with an oscillation of 100 years. This is a rather short time interval for a TRO oscillation and is too long for an invisible third component orbital period unless it is a neutron star. The probable error of a single observation was 1.3% in B, 1.2% in V, and 1.3% in U. At present, we have calculated a contact solution using the Wilson Code (Wilson 1994, 1990, Wilson & Devinney 1971). Tests for a third light gave a null result. The results show that TY UMa consists of solar-type G0 and G2V spectral type

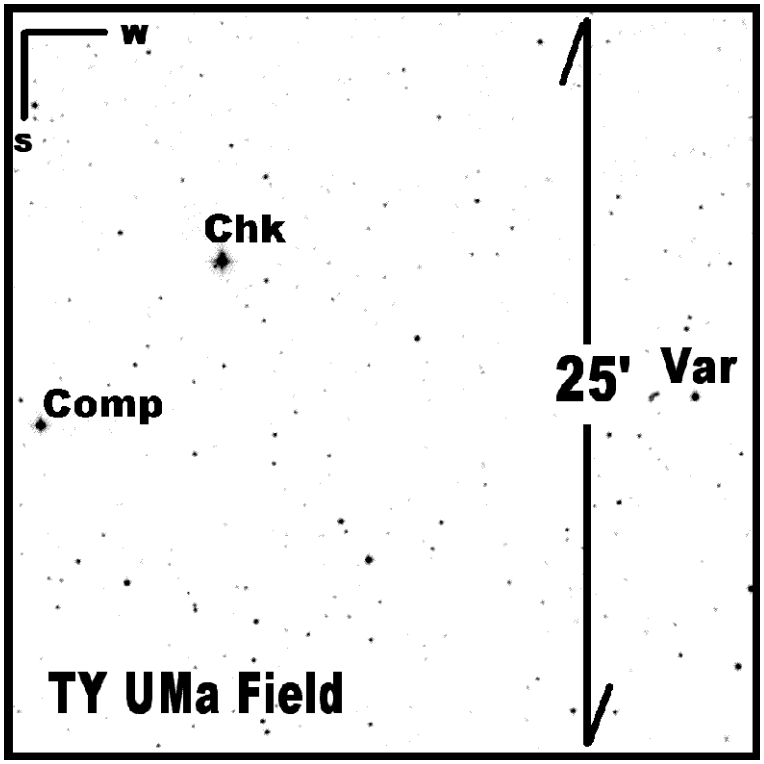

Figure 1. Finding chart of TY UMa, Var, the comparison, Comp, and the check star, Chk

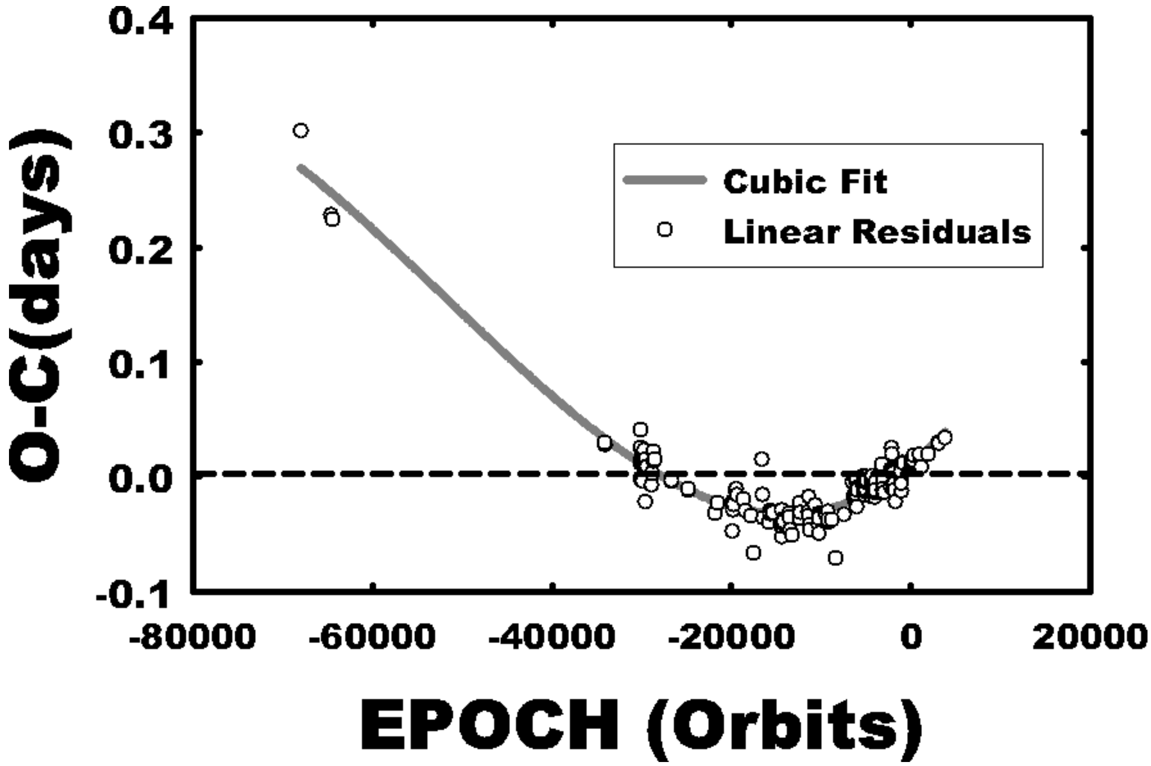

Figure 2. The $O-C$ linear residuals and the computed cubic ephemeris from Equation (3)

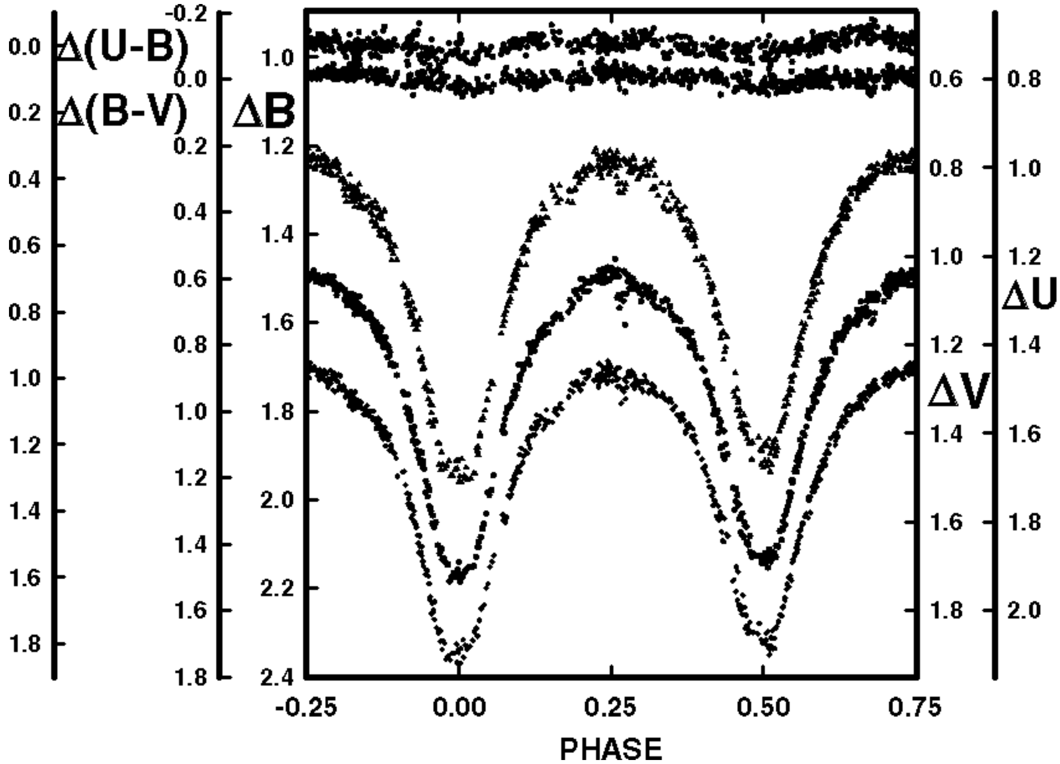

Figure 3. U, B, V standard magnitude light curves as defined by the individual observations

components with a mass ratio of 2.601(2) (or 0.38 for comparison to the previous mass ratios) and a very small fill-out factor of 9%. The model typical is for a W-type W UMa shallow contact system (massive star is slightly cooler). The W-type phenomena is due to wide spread cool spot activity on the hotter more massive star which makes its apparent temperature cooler (Hendry & Mochnacki 2000). This binary has been heavily patroled in the past and this work should be continued into the future. It is truly an astrophysically important close binary.

Much of the analysis of this binary was done as an undergraduate physics research project by MLS. We wish to thank Lowell Observatory for their allocation of observing time for the travel support from the University of South Carolina, and Bob Jones University.

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UZ CVn: A CENTURY OF PERIOD INCREASE

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UZ CVn (= BV 96 = HIP 61029 = GSC 3018 255, $12^h30^m27\overset{s}{.}7$, $+40^\circ30'31\overset{''}{.}9$, 2000.0), was discovered by Kippenhahn (1955) and found to be a pulsating star of RRab type by Strohmeier and Knigge (1961). Their elements, listed in the GCVS (Kholopov, 1985),

$$\text{Max.} = \text{HJD } 2426427.3806 + 0\overset{d}{.}6977829 \times E \tag{1}$$

were derived from photographic plates They are obviously no longer valuable because the period has changed continuously. In order to study the evolution of the period of UZ CVn during the last century, we have gathered all the instants of maximum light published in the literature and we have also performed our own measurements.

There are only 13 photoelectric measurements in V and R made between March 1990 and December 1991 resulting in the determination of one instant of maximum (Schmidt et al., 1995). The 127 CCD transits accepted from the Hipparcos satellite measurements (1990–1993) were studied by Fernley et al. (1998) who obtained a period of $0\overset{d}{.}697783$ with a very scattered light curve. We took into account the epoch of the Hipparcos catalogue only. The photographic data are very scattered instants of bright light obtained from the inspection of sky patrol plates. The first 59 times of maximum found from Bamberg and Sonneberg plates taken between 1931 and 1960, including 5 instants published before by Filatov (1960) and 38 instants derived by Döppner from Sonneberg plates, were published by Strohmeier and Knigge (1961), establishing ephemeris (1). A re-inspection of the Sonneberg plates done by one of us (T.B.) has evidenced the timings assigned to Döppner to be in fact geocentric! They have been corrected for further analysis. Later on, a further set of 80 instants of bright light was published by Strohmeier and Bauernfeind (1968) as a result of the investigation of Harvard photographic plates taken between 1901 and 1953.

A GEOS team made 26 photoelectric measurements of UZ CVn in the B and V filters of the Geneva system at the Jungfraujoch observatory during two nights in January 1997. A new time of maximum could be determined. Seven additional measurements were obtained at the same observatory in 1998 (see Figure 1). Two visual observers, J.-P. Verrot and J. Vandenbroere, determined 20 further instants of maximum from their estimates made between 1994 and 2001. To close the remaining gap in the data between 1960 and 1990, T.B. has used 554 Sonneberg Observatory sky patrol plates taken between

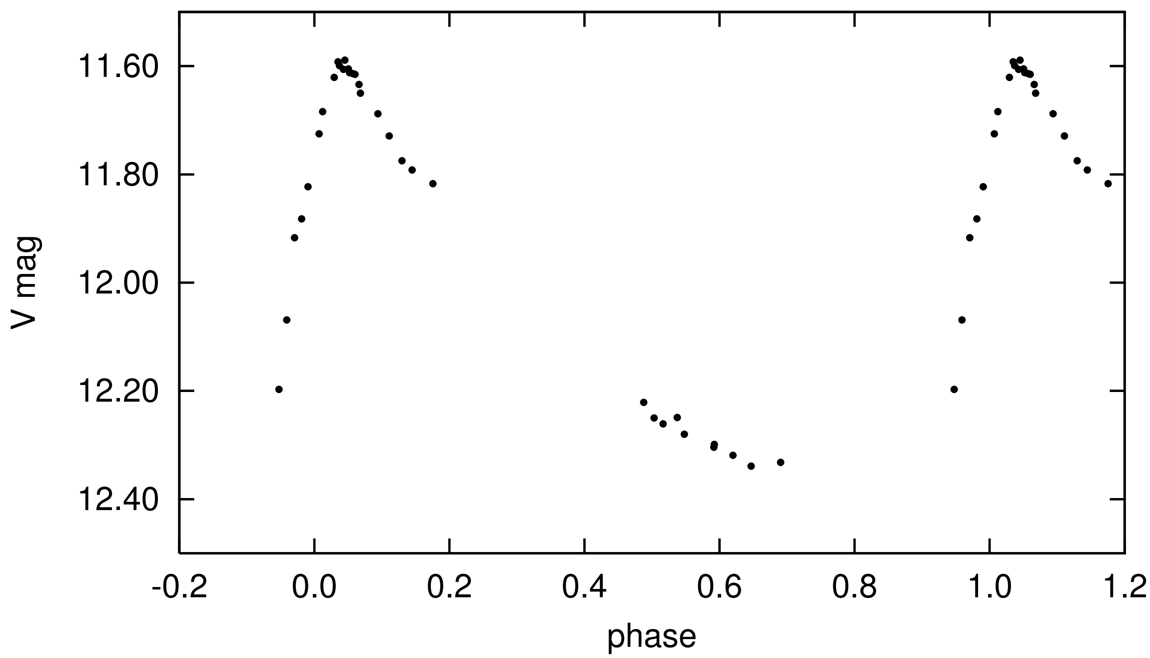

Figure 1. V lightcurve of UZ CVn according to ephemeris (2)

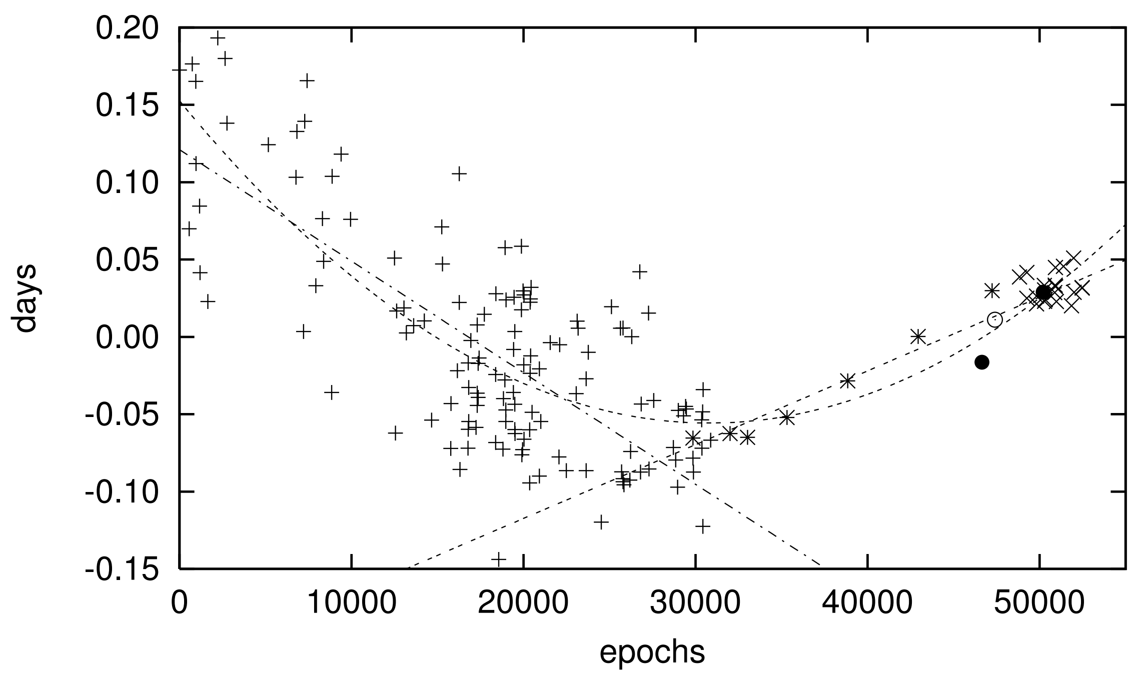

Figure 2. $O-C$ diagram of UZ CVn according ephemeris (2).
The symbols refer to the kind of observation: $\times$ (visual), $+$ (photographic), $*$ (photographic normal maxima), $\circ$ (HIPPARCOS), $\bullet$ (photoelectric)

1959 and 1993. From 69 newly found instants, 7 normal maxima in consecutive intervals were derived for further analysis.

Taking into account all the available material, we are able to document the behaviour of the period of an RR Lyrae star over a whole century. The complete list of all the observed times of maximum is available from the IBVS website as file 5170-t1.txt. A linear least-squares fit, made with 163 instants of maximum, consisting of two photoelectric instants ($w = 10$), seven photographic normal maxima ($w = 4$), one Hipparcos and 20 visual instants ($w = 3$) and 133 photographic instants ($w = 1$), covering the years from 1901 to 2001, has yielded the following ephemeris:

$$\begin{array}{c} \text{Max.} = \text{HJD } 2415423.9927 + 0\overset{\text{d}}{.}69778714 \times E. \\ \pm\, 74 \qquad\qquad \pm\, 47 \end{array} \tag{2}$$

As Figure 2 points out, the trend of the $O - C$ values can be represented either by an abrupt period change around epoch 28000 or by a parabolic fit.

From JD 2415400 (approx.) to JD 2435000 (approx.):

$$\begin{array}{c} \text{Max.} = \text{HJD } 2415424.1137 + 0\overset{\text{d}}{.}69777993 \times E. \\ \pm\, 120 \qquad\qquad \pm\, 66 \end{array} \tag{3}$$

From JD 2435000 (approx.) to JD 2452100 (approx.):

$$\begin{array}{c} \text{Max.} = \text{HJD } 2450460.6095 + 0\overset{\text{d}}{.}69779191 \times E. \\ \pm\, 67 \qquad\qquad \pm\, 15 \end{array} \tag{4}$$

Alternatively, the quadratic least squares fit yields the following elements:

$$\begin{array}{c} \text{Max.} = \text{HJD } 2415424.1453 + 0\overset{\text{d}}{.}69777362 \times E + 2.19 \times 10^{-10} \times E^2. \\ \pm 91 \qquad\qquad \pm 69 \qquad\qquad \pm 11 \end{array} \tag{5}$$

Assuming the last case, the period of UZ CVn has been established to have increased by a constant rate of $dP = 6\overset{\text{d}}{.}28 \times 10^{-10}$ per day during the last century and thus has increased by 1.98s in the same time. Such rates are found to be typical in numerous cases among RR Lyrae variables.

We want to acknowledge M. Dumont (GEOS) and L. Zimmerman (Cercle Astronomique de Bruxelles) for discussion and Peter Kroll (Sonneberg Observatory) for the use of the plate archive. This research made use of the SIMBAD database operated by the CDS at Strasbourg.

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NSV 1012: A NEW ECLIPSING BINARY

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The variability of this star (GSC 4317 0505) was discovered by Strohmeier (1959), who describes it as an eclipsing binary with light changes ranging between photographic magnitudes $11^{\mathrm{m}}.0$ to $11^{\mathrm{m}}.8$. A confirmation was published later by Strohmeier and Knigge (1961). This information, together with the spectral type of A4, is listed in the NSV catalogue (Kholopov 1982). Visual observations performed by Verrot and Vandenbroere have yielded a first period of $2^{\mathrm{d}}.273$ (Verrot 2000). This value could be confirmed by photoelectric observations made by Martignoni, but his measurements cover only a part of the light curve without the ascending branch of the minimum. Observations on Sonneberg Sky-Patrol plates (Berthold) were used to refine the elements with the help of a long time base. Due to the very large number of plates available for the region of NSV 1012, estimations were performed in only two intervals of time. The first set includes 341 plates out of the years 1962–1967 and a comparable number of plates out of the years 1981–1985 was searched for weakenings.

A least squares fitting of all available minima has yielded the following linear ephemeris:

$$\begin{array}{rl} \mathrm{Min.\,I} = \mathrm{HJD}\ 2451450.242 + & 2^{\mathrm{d}}.2726178 \times E. \\ \pm 0.007 & \pm 0.0000020 \end{array} \qquad (1)$$

The corresponding photographic light curve is given in Figure 1. A decision whether the given epoch in ephemeris (1) denotes the primary or secondary minimum is still outstanding. Further CCD photometry is urgently needed. Using blue magnitudes from the TYCHO2 catalogue for the comparison stars in Table 1, NSV 01012 shows photographic light changes within $11^{\mathrm{m}}.85$ and $12^{\mathrm{m}}.90$. The difference to the range of variation reported by Strohmeier obviously results from a systematic error in his comparison scale. The magnitudes derived from the Sonneberg plates are well in agreement with the values given for the uneclipsed star in some modern catalogues (USNO A2.0: $12^{\mathrm{m}}.1$ pg; TYCHO2: $11^{\mathrm{m}}.841$ B_T).

Table 2 clearly points out the constancy of the period within the whole investigated interval. Each of the photographic instants in this table was derived only from a single sky-survey plate, so the scatter of the $O-C$ values is comprehensible.

Table 1: Comparison stars

Designation	GSC	TYCHO2 B mag
a	4317 1077	11.11
b	4317 0923	11.55
c	4317 0913	11.89
d	4317 0960	12.62
e	4317 0671	12.95

Table 2: Minima of NSV 1012 according to ephemeris (1)

HJD 24...	Epoch	$O-C$	Observer	HJD 24...	Epoch	$O-C$	Observer
38856.540	−5541.5	0.010	Berthold	39390.595	−5306.5	−0.001	Berthold
38739.458	−5593	−0.033	Berthold	39499.678	−5258.5	−0.003	Berthold
38530.480	−5685	0.070	Berthold	45074.487	−2805.5	0.074	Berthold
38555.438	−5674	0.029	Berthold	45223.312	−2740	0.043	Berthold
38556.494	−5673.5	−0.051	Berthold	45407.310	−2659	−0.041	Berthold
38613.414	−5648.5	0.054	Berthold	45583.467	−2581.5	−0.012	Berthold
38622.410	−5644.5	−0.041	Berthold	45650.497	−2552	−0.024	Berthold
38638.390	−5637.5	0.031	Berthold	45674.408	−2541.5	0.024	Berthold
38239.465	−5813	−0.050	Berthold	45907.390	−2439	0.063	Berthold
38288.398	−5791.5	0.022	Berthold	45940.349	−2424.5	0.069	Berthold
38322.385	−5776.5	−0.080	Berthold	45990.256	−2402.5	−0.022	Berthold
38372.444	−5754.5	−0.019	Berthold	46200.460	−2310	−0.035	Berthold
38407.708	−5739	0.020	Berthold	51185.482	−116.5	−0.000	Vandenbroere
38413.403	−5736.5	0.033	Berthold	51459.330	4	−0.003	Verrot
38415.683	−5735.5	0.040	Berthold	51460.418	4.5	−0.051	Verrot
38440.659	−5724.5	0.018	Berthold	51492.295	18.5	0.010	Verrot
38473.626	−5710	0.032	Berthold	51509.306	26	−0.024	Verrot
37939.575	−5945	0.046	Berthold	51525.233	33	−0.006	Verrot
37940.623	−5944.5	−0.042	Berthold	51550.247	44	0.009	Verrot
38089.474	−5879	−0.048	Berthold	51575.257	55	0.021	Verrot
38113.403	−5868.5	0.019	Berthold	51576.334	55.5	−0.038	Verrot
39023.533	−5468	−0.035	Berthold	51600.286	66	0.052	Verrot
39040.574	−5460.5	−0.039	Berthold	51601.346	66.5	−0.026	Verrot
39056.520	−5453.5	−0.001	Berthold	51609.323	70	−0.003	Verrot
39088.256	−5439.5	−0.081	Berthold	51793.372	151	−0.035	Verrot
39205.393	−5388	0.016	Berthold	51842.279	172.5	0.010	Verrot
39256.472	−5365.5	−0.039	Berthold	51908.236	201.5	0.062	Verrot
39289.443	−5351	−0.021	Berthold	51934.313	213	0.003	Verrot
39355.398	−5322	0.028	Berthold	51951.290	220.5	−0.064	Verrot
39380.371	−5311	0.002	Berthold	51984.322	235	0.014	Verrot
39388.372	−5307.5	0.049	Berthold				

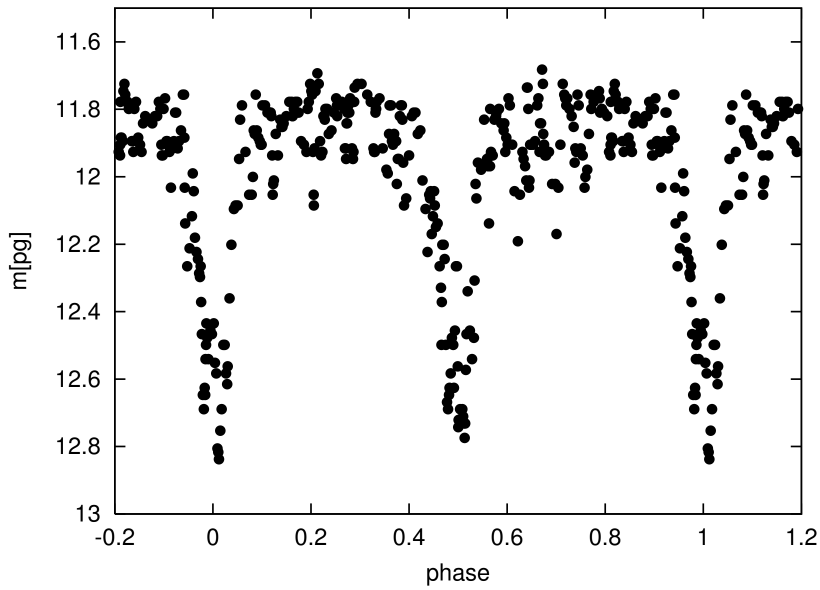

Figure 1. Photographic light curve of NSV 1012. The dots refer to sliding means ($N = 3$) of the individual estimates

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NOVA Sgr 2001 NO. 2 = V4739 Sgr

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Nova Sgr 2001 No. 2 was discovered by Pereira in Portugal on 2001 Aug 26.866 at magnitude $m_V = 7.6$ (Pereira 2001). Maximum occurred a few hours later at Aug 27.10. Apart from a handful of early visual magnitude estimates around maximum, photoelectric $UBV(RI)_\mathrm{C}$ photometry has been obtained by Kilmartin and Gilmore at Mt John University Observatory since Aug 27.36. The visual light curve is shown in Fig. 1 and colour curves in Fig. 2 for the first week since discovery.

Nova Sgr 2001 No. 2 appears to be the fastest classical nova ever observed, with a t_2 value (time for 2 magnitude decline from maximum in visual) of only 0.70 ± 0.08 d and $t_3 = 1.60 \pm 0.12$ d. The light curve is a smooth steep decline from $m_V(\mathrm{max}) = 6.5 \pm 0.1$ at $t_0 = \mathrm{JD}\ 2452148.60 \pm 0.05$.

Other very fast novae (see Warner 1995, Table 5.2) have all had values of t_2 greater than 1 d. These include V838 Herculis in 1991 ($t_2 = 1.2$ d) and V1500 Cygni ($t_2 = 2.9$ d). To confirm these values, Ingram et al. (1992) gave t_2 as less than 3 days for V838 Her, and Young et al. (1976) stated that t_2 for V1500 Cyg was 2.4 d. According to Payne-Gaposchkin (1957) any nova with $t_2 < 10$ d is in the category of being very fast.

Photometry was done with the 0.6-m $f/16$ Cassegrain O.C. reflector at Mt John by photon counting with a cooled EMI 9202 (S20B) photomultiplier. The system has been standardized to the Johnson–Cousins $UBV(RI)_\mathrm{C}$ system by repeated measures of Cousins E-region standards (see Menzies et al. 1989 and references therein) over many years.

Using differential photometry from Cousins standards E745 and E746 Kilmartin calibrated two stars near the nova on August 27. All stars were observed at air mass less than 1.05 with a 21″ aperture in a photometric sky and good seeing. The magnitudes and colours adopted for these stars, along with their HD numbers, are listed in Table 1. The standard deviation of nearly all measures was $0\overset{\mathrm{m}}{.}009$ or less except for $V - I_\mathrm{C}$ on the last 2 nights (where it was ± 0.2). These HD stars are noted as constant in the Hipparcos-Tycho database. All subsequent photometry was made differentially from the listed stars as comparison and check respectively.

We have calculated the absolute magnitude of V4739 Sgr at maximum from the rate of decline by extrapolating the calibration of Della Valle and Livio (1995). Fortunately M_V is not very sensitive to t_2 for very fast novae. The value obtained is $M_V = -9.07 \pm 0.17$ for V4739 Sgr, where the error bar arises almost entirely from the uncertainty in the calibration rather than in the measured t_2 value.

Table 1: Comparison and check stars from Mt John University Observatory

Comparison & check stars	V	$U-B$	$B-V$	$V-R_C$	$V-I_C$
HD169337	7.507	+0.465	+0.976	+0.669	+1.358
HD169586	6.757	+0.092	+0.535	+0.305	+0.597

The reddening can be estimated using $(B-V)_0$ at time t_2, which is -0.02 ± 0.04 for novae, as found by van den Bergh and Younger (1987). The interpolated $(B-V)_{\rm obs}$ colour index at t_2 is 0.44 ± 0.02 giving $E_{B-V} = 0.46 \pm 0.04$ and hence $A_V = 3.2E_{B-V} = 1.47 \pm 0.13$. A relatively high value is also suggested by the strong IS NaD line (Vanlandingham 2001).

The distance to the nova then follows and is $d = 6600 \pm 700$ pc with a distance modulus $(5\log d - 5)$ of 14.1 ± 0.2. Given that the star has $(l, b) = (3\overset{\circ}{.}2, -8\overset{\circ}{.}0)$ this distance places it near the galactic centre.

Capaccioli et al. (1989) have found that the absolute visual magnitude of classical novae 15 days after maximum is $M_{15} = -5.69 \pm 0.14$, independent of speed class. With an apparent magnitude of $m_{15} = 13.42 \pm 0.02$ (the small uncertainty is due to the small error in time of maximum) the distance modulus would be 17.6 ± 0.2, much greater than before, and implying a distance far beyond the galactic centre. We conclude that the value of M_{15} may be substantially less luminous for very fast novae, as was also suggested by van den Bergh and Younger (1987) for V1500 Cyg. Hence for extremely fast novae ($t_2 < 2$ d) it is reasonable to suggest that the M_{15} calibration may not be valid.

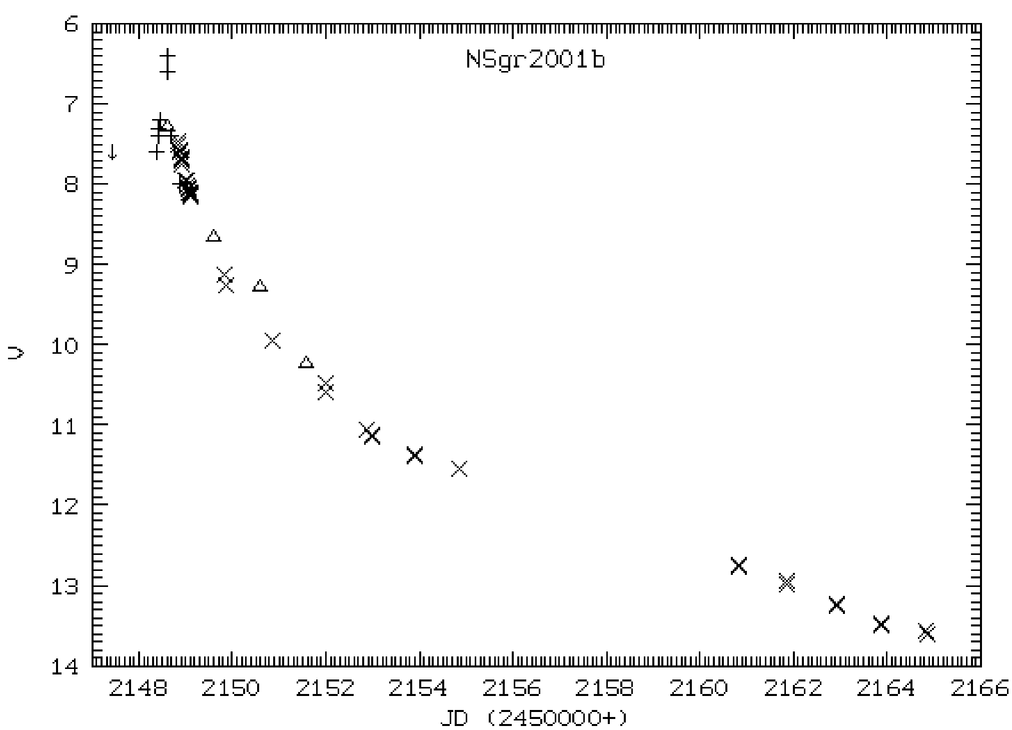

Figure 1. Visual light curve of V4739 Sgr. × photoelectric photometry (MJUO); + visual estimates from IAU Circ. 7692; △ CCD photometry from IAU Circ. 7692,7702; ↓ visually estimated upper limit from IAU Circ. 7692

Table 2: Photoelectric photometry of V4739 Sgr from Mt John University Observatory

HJD (2450000 +)	V mag	$U-B$	$B-V$	$V-R_C$	$V-I_C$
2148.839	7.46	−0.71	0.55	0.53	0.99
2148.853	7.51	−0.74	0.56	0.55	1.01
2148.869	7.58	−0.75	0.55	0.56	1.04
2148.875	7.59	−0.76	0.56	0.56	1.04
2148.908	7.66	−0.78	0.55	0.60	1.10
2148.918	7.69	−0.80	0.54	0.61	1.12
2148.927	7.71	−0.81	0.55	0.61	1.11
2148.935	7.75	−0.81	0.54	0.62	1.13
2149.006	7.94	−0.86	0.53	0.68	1.22
2149.014	7.95	−0.87	0.53	0.70	1.24
2149.043	8.02	−0.87	0.52	0.72	1.26
2149.052	8.04	−0.87	0.53	0.72	1.27
2149.061	8.05	−0.88	0.53	0.73	1.28
2149.070	8.06	−0.89	0.54	0.73	1.29
2149.079	8.07	−0.89	0.54	0.74	1.29
2149.088	8.09	−0.87	0.52	0.75	1.30
2149.097	8.10	−0.87	0.52	0.75	1.31
2149.106	8.12	−0.89	0.55	0.77	1.33
2149.115	8.16	−0.90	0.53	0.77	1.33
2149.818	9.12	−0.93	0.28	1.09	1.53
2149.827	9.13	−0.89	0.27	1.09	1.56
2149.866	9.27	−0.86	0.26	1.13	1.56
2150.843	9.94	−0.84	−0.02	1.37	1.44
2150.847	9.95	−0.85	−0.04	1.39	1.46
2150.851	9.95	−0.87	−0.02	1.38	1.45
2150.856	9.94	−0.85	−0.02	1.36	1.45
2151.997	10.58	−0.68	−0.20	1.47	1.25
2152.002	10.49	−0.67	−0.11	1.43	1.23
2152.873	11.07	−0.64	−0.36	1.53	1.14
2152.878	11.06	−0.65	−0.36	1.54	1.16
2152.999	11.12	−0.65	−0.35	1.55	1.16
2153.004	11.14	−0.65	−0.38	1.56	1.15
2153.910	11.39	−0.66	−0.40	1.64	1.21
2153.914	11.37	−0.66	−0.38	1.60	1.19
2154.855	11.55	−0.71	−0.32	1.68	1.14
2154.861	11.54	−0.71	−0.32	1.66	1.15
2160.830	12.75	−0.79	−0.32	1.41	1.02
2160.836	12.76	−0.69	−0.30	1.42	1.02
2161.853	12.94	−0.75	−0.32	1.37	0.76
2161.858	12.98	−0.68	−0.37	1.42	0.64
2162.921	13.25	−0.81	−0.43	1.39	1.12
2162.924	13.22	−0.75	−0.39	1.35	1.01
2163.862	13.49	−0.82	−0.47	1.45	0.8
2163.869	13.51	−0.82	−0.48	1.45	1.0
2164.846	13.56	−0.83	−0.33	1.30	0.7
2164.850	13.62	−0.78	−0.43	1.35	0.5

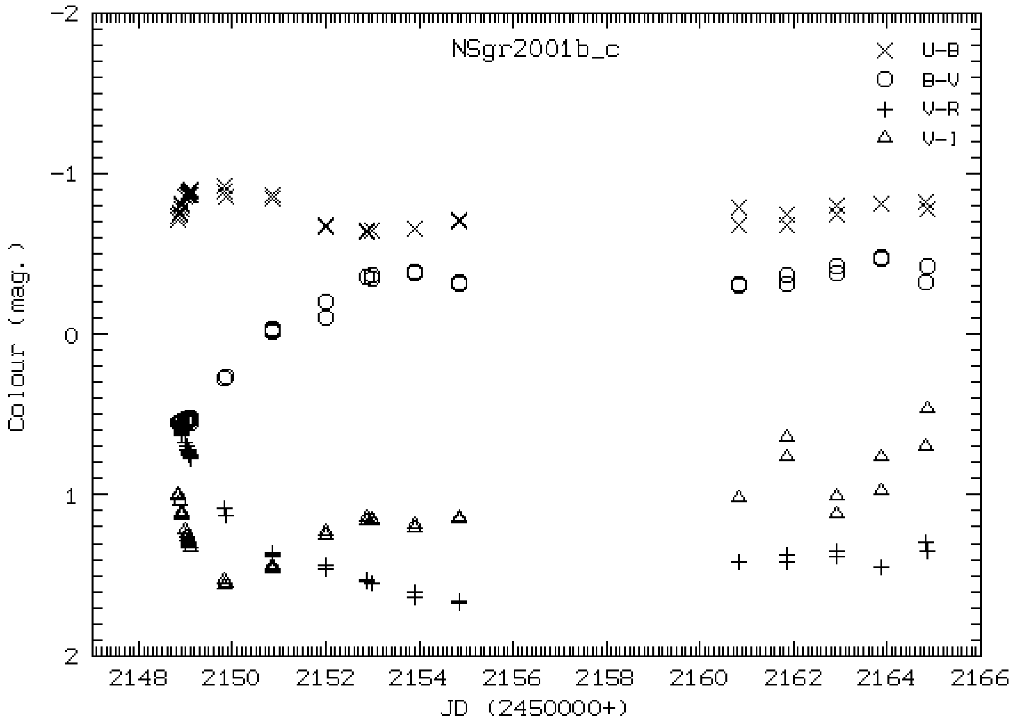

Figure 2. Photoelectric colour curves of V4739 Sgr from Mt John

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OBSERVATIONS OF H-ALPHA EMISSION IN VV CEPHEI

POLLMANN, ERNST

http://pollmann.ernst.org

VV Cep is an eclipsing binary with a period of about 20.4 years that is comprised of a M2 Iab primary star and an early B secondary star. Goedicke (1939) was first to spectroscopically observe it. Wright (1977) inferred the existence of intermittent mass transfer and an Hα emitting disk. Kawabata et al. (1981) and Moellenhoff et al. (1978, 1981) further described what appears to be an accretion disk around the B star.

Appropriately equipped amateur astronomers are now able to make scientific contributions in spectroscopy. This is largely due to the availability of highly efficient CCD cameras. The author built a Maksutov type mirror-prism- spectrograph with a CCD camera as the detector. The instrument has a 100 mm aperture, 1000 mm focal length, and a prism with breaking angle of 30 degrees. Its central wavelength is fixed at 6563 Å and its dispersion is 3 Å/pixel. With this equipment the author observed VV Cep from July 1996 until May 2001 and obtained 148 spectra. This period included an eclipse of the B star from 1997 to 1999.

With the binary at magnitude 4.9, exposure times were about 4 minutes for each spectrum to achieve 70-80range of the sensor. 20 spectra were combined for measurement. The integration width for computation of equivalent width (W) for the Hα emission line was 6 nm. The formula to compute W was

$$W = \int_{\text{line}} (1 - I(\lambda)/I_c(\lambda))\,\mathrm{d}\lambda.$$

$I_c(\lambda)$ is the continuum intensity at wavelength λ and $I(\lambda)$ is intensity of the emission line at the same wavelength. A linear function was usually sufficient to fit the continuum over the 6 nm wavelength range centered on Hα. This was done in a trial and error process. Figure 1 is a representative spectrum.

Figure 2 is a plot of W for Hα emission as a function of time. The eclipse of the emitting disk began in March 1997 (JD 2450511) and ended 673 days later. Ingress and egress lasted 128 and 171 days, respectively. The B star and disk were eclipsed for 373 days. Saito et al. (1980) observed the 1976–78 eclipse with UBV photometry. In that case, totality lasted about 300 days, significantly shorter than the latest eclipse, and the entire event required about 1000 days.

While after the ephemeris of Gaposchkin (1937) the mid-point of the eclipse was to be expected at JD 2450790, this time can be determined from Fig. 2 at JD 2450827, thus with a delay of 37 d (in the table the individual values of EW with the belonging Julian Date are specified). Graczyk et al. (1999) determine the mid-point of the eclipse 1997/99

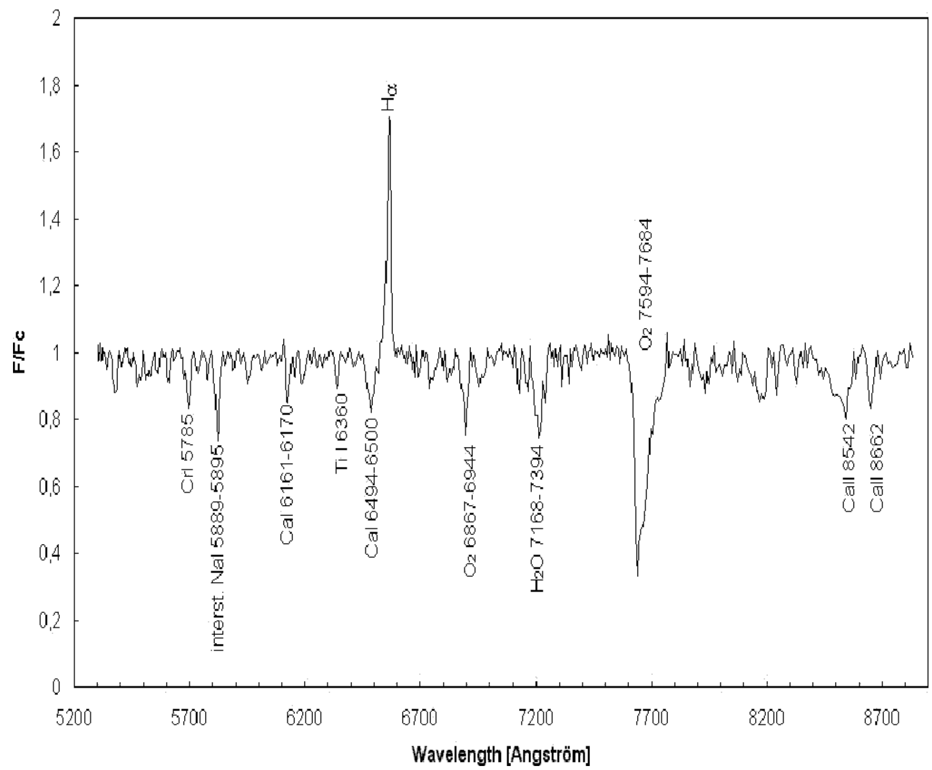

Figure 1. Standardized CCD spectrum of VV Cep

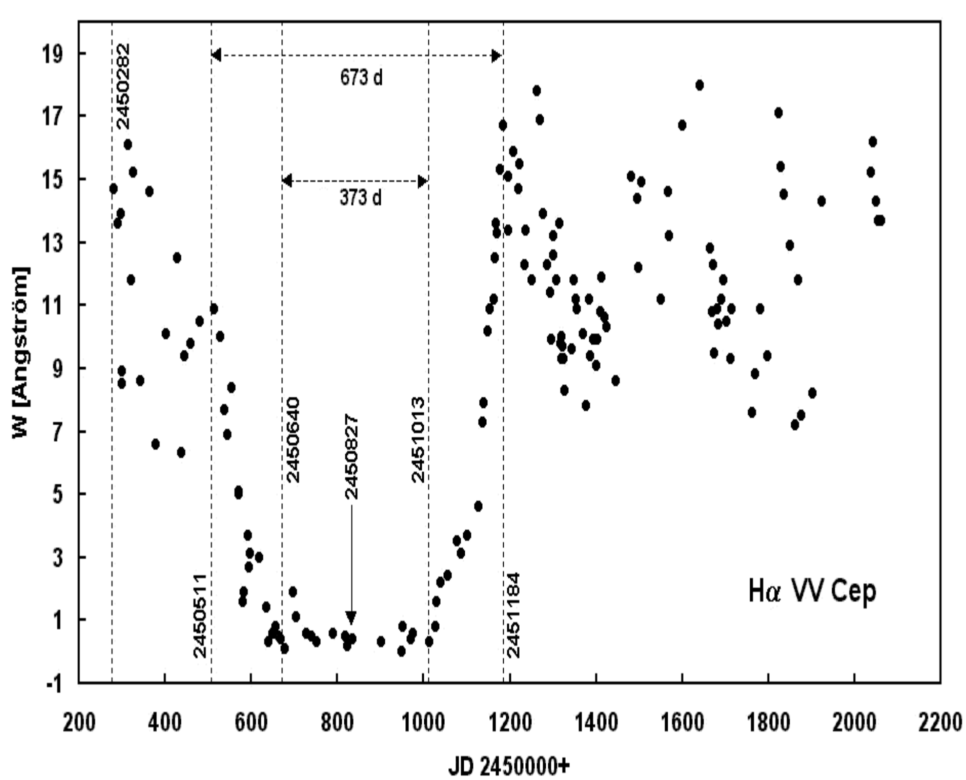

Figure 2. Plot of W for Hα emission as a function of time

from UBV photometry at approximately JD 2450855, thus with 65 d delay. Leedjärv et al. (1999) obtained a similar value of 68 d compared with the ephemeris in Gaposchkin (1937) likewise from UBV photometry as well as optical spectroscopy.

Perhaps the most interesting feature of Figure 2 is the behavior of Hα emission outside of eclipse. Large fluctuations in W occurred continuously over about 4.8 years. A possible explanation is variable mass accretion from the M supergiant to the accretion disk as described by Wright (1977) and Stencel et al. (1993). There may also be related variations in the disk's temperature and density. Further, the M supergiant has a semiregular pulsation period of 116 days (Saito et al. 1980) that may affect the rate of accretion. Since the disk is the apparent source of Hα emission, it is the best candidate to explain ongoing changes in intensity.

V/R measurements of Hα by Kawabata et al. (1981) during the 1976-1978 eclipse may indicate that the distribution of matter in the disk is not homogeneous. The stronger violet emission peak may be formed by greater density in the left side of the disk which rotates anticlockwise. Different strengths of the violet and red peaks during the 1997–1999 eclipse can be inferred from the ingress and egress branches of the plot in Figure 2. During ingress, with the disk's left side hidden and its right side in view, on average $W = 11$ Å. At egress, with the left side emerging from eclipse, $W = 17$ Å.

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PHOTOELECTRIC MINIMUM TIMES OF TWO RS CVn TYPE BINARY SYSTEMS: RT And AND SV Cam

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Observatory and telescope:
40-cm Cassegrain telescope of the TÜBİTAK National Observatory (Turkey)

Detector:	OPTEC SSP-5A photometer containing a side-on R1414 Hamamatsu photomultiplier

Method of minimum determination:
Kwee & van Woerden (1956)

Observed star(s):

Star name	Type (GCVS)	Coordinates (J2000) RA	Dec	Ephemeris E	P	Source
RT And	RS	23 11 10	+53 01 33	2432443.7816	0.62893067	1
SV Cam	RS	06 41 19	+82 16 02	2449350.3037	0.593071	2

Source(s) of the ephemeris:
1. Pribulla et al. (2000)
2. Pojmański (1998)

Times of minima:

Star name	Time of min. HJD 24...	Error	Type	Filter	$O-C$	Rem.
RT And	51015.45144	.00009	I	mean (BVR)	−0.02391	
	51016.39726	.00036	II	mean (BVR)	−0.02149	
	51437.46258	.00016	I	mean (BVR)	−0.02525	
	51438.40493	.00015	II	mean (BVR)	−0.02630	
SV Cam	51017.43356	.00013	I	mean (BVR)	0.00728	
	51137.53043	.00031	II	mean (BVR)	0.00727	

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A 100 YEAR PERIOD STUDY OF V523 CASSIOPEIAE: A TRIPLE STAR SYSTEM?

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V523 Cassiopeiae [WR16, CSV 5867, GSC 3257-167] has figured prominently in studies of very short period K-type non-degenerate eclipsing binaries over the past 15 years or so. At 336.5 minutes, its period is one of the shortest among late type, W UMa contact binaries. V523 Cas is also noted for variations in its light curve and for large period changes. One of the authors (DBW) has acquired 50 times of low light found from a search of the archival photographic Harvard/SAO plate stacks. The timings cover the interval from 1901 to 1942 and greatly extend the baseline over which the period behavior of V523 Cas may be studied. In addition, seven mean epochs of minimum light were determined from observations made during three primary and four secondary eclipses from 1999 observations at Lowell Observatory carried out by DRF. These times of minimum light are announced in Table 1 (available electronically through IBVS Web-site as file 5175-t1.txt) with standard errors in parentheses. Also listed is the starting epoch of our light elements presented below. These were combined with the over 400 timings of minimum light available in the literature (see Table). These span the interval from 1963 to 2001, yielding a hundred year period history (with a 21 year gap) spanning nearly 185,000 orbits. This is probably the longest period study ever undertaken for a W UMa binary. The amazing results are reported here.

A least-squares linear fit to all available timings resulted in the following linear light elements:

$$\text{J.D. Hel. Min I} = 2446708\overset{\text{d}}{.}7706(27) + 0.23368973(8) \times E, \tag{1}$$

where the probable errors are in parentheses. The $O - C$ residuals for Equation (1) are plotted in Figure 1. The $(O - C)_1$ residuals in Table 1 calculated with these light elements. Mathematically, the data strongly suggest the sum of a sinusoidal variation and a continuous period increase. We fitted the data to just such an equation. This equation gives a final ephemeris of:

$$\begin{aligned}\text{J.D. Hel. Min I} = 2446708\overset{\text{d}}{.}800(9) + 0.23369099(18) \times E +\\ + 1.02(9) \times 10^{-11} \times E^2 + 0.036(5) \times \sin[4.0(0.3) \times 10^{-5} \times E - 1.0(0.1)].\end{aligned} \tag{2}$$

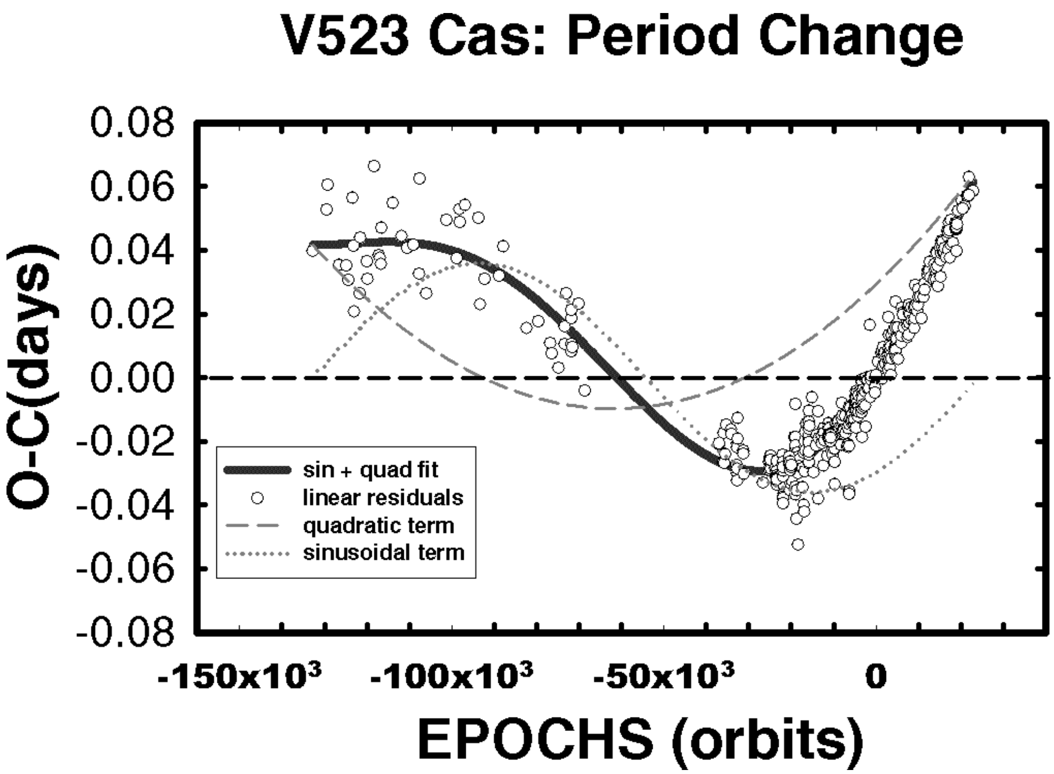

Figure 1. $O-C$ residuals calculated from Equation (1) for V523 Cas overlain with the sum of a sinusoid quadratic ephemeris. The sinusoid and quadratic curves also are shown separately

The fit is plotted with the data in Figure 1, and the $(O-C)_2$ residuals for Equation (2) are given in Table 1. The correlation coefficient for this excellent fit, $R = 0.97$ (a perfect curve fit would yield $R^2 = 1$). The quadratic term, $1\overset{d}{.}02 \times 10^{-11} \times E^2$, may be due to mass accretion onto the primary component or some as yet unexplained physical process causing the binary components to continuously separate. Such a continuous period increase or decrease is not unusual for short period contact binaries. However, the sinusoidal behavior with an amplitude of 0.036(5) d (light time: 6.22 AU) is seen only in systems that have a third body present in the system. Assuming that this is the case, and that the inclination from our orbital solution for the close pair is the same as the larger orbit, from Kepler's third law and Equation (2) we obtain a mass for the third star of 0.37 solar masses. This is similar to the masses of the stars that comprise the contact binary. Milone, Hrivnak, and Fisher (1985) point source model gives a total mass of $\sim$ 0.88 solar masses, our simultaneous (using our 1999 light curves) Roche-lobe model yields 0.96. The period of the larger system is 101(8) years. If there is a third member of this system as we suggest here, then from Figure 1 we see the companion should be near greatest separation now. The size of the orbit and the distance of the system result in a maximum angular separation of about $0\overset{''}{.}3$. The expected V magnitude of the companion should be about 15.0. With adaptive optics on a large telescope with good seeing it should be possible to resolve the companion, if it exists.

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BrhV35 = GSC 0703-1930 IS A SHORT-PERIOD RRc VARIABLE

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BrhV35 (GSC 0703-1930, $05^{\rm h}17^{\rm m}22\overset{\rm s}{.}0$ $+10^\circ18'28''$, 2000, $V \approx 12\overset{\rm m}{.}7$) was discovered as a short-period variable of unknown type by Bernhard (2000) as part of a programme to discover and classify new variables in selected fields on the edge of the northern Milky Way (see Bernhard & Lloyd 2000 for further details). Following the eight survey observations, additional long runs were made on one night by Bernhard, and on six nights by Kiyota. The observations were made using a 20-cm Schmidt–Cassegrain telescope and an unfiltered Starlight Xpress SX CCD camera with a Sony ICX027B chip (see Bernhard & Lloyd 2000), and a 25-cm Schmidt–Cassegrain telescope with an Apogee AP-7 CCD camera and Johnson V filter. The comparison stars used were GSC 0703-2180, $V \approx 12\overset{\rm m}{.}2$ and GSC 0703-1901 $V \approx 12\overset{\rm m}{.}2$, which were found to be constant with a magnitude difference $< 0\overset{\rm m}{.}03$.

The magnitudes, relative to GSC 0703-1901, of the two data sets were simply combined; it was not necessary to apply any offset to the unfiltered observations. The periodogram of the data shows two possible periods, close to 4.4 and 5.4 cycles day^{-1}, which are part of a series of strong 1-day aliases. However, the ~ 4.4 c/d is inconsistent with the data. The longer period emerges unambiguously, giving the ephemeris of maximum light

$$\begin{array}{rl} \mathrm{JD_{Max}} = & 2451614.873 + 0.22630 \times E. \\ & \qquad\quad \pm 5 \qquad\quad\;\; \pm 1 \end{array}$$

The light curve using this ephemeris is shown in Figure 1, and has a slightly non-sinusoidal shape with a full amplitude of $0\overset{\rm m}{.}4$. The variation is consistent with a c-type RR Lyrae star, but the period is on the extreme edge of the observed range, making it one of the shortest period RRc variables known. In the GCVS only HX Ara ($P = 0\overset{\rm d}{.}219$) has a shorter period (Kholopov et al. 1998). The amplitude and shape of the light curve suggest that it is neither a δ Scuti nor β Cephei variable.

The observed colour from the USNO A2.0 catalogue (Monet et al. 1999), $b - r = 0.1$, is quite blue, and is consistent with other RR Lyrae stars found by this programme (Bernhard & Lloyd 2000). As the variation is not large, and the two POSS plates on which these magnitudes are based were taken consecutively, the observed value is probably a fair indication of the true $b - r$.

The galactic co-ordinates, $l = 192, b = -16$, place the star towards the galactic anti-centre, at intermediate galactic latitude, and argue against the δ Scuti or β Cephei interpretation. They are entirely consistent with an RR Lyrae star, and coincidentally, the galactic latitude is the same as HX Ara.

This research made use of the SIMBAD database, operated by the CDS at Strasbourg, France.

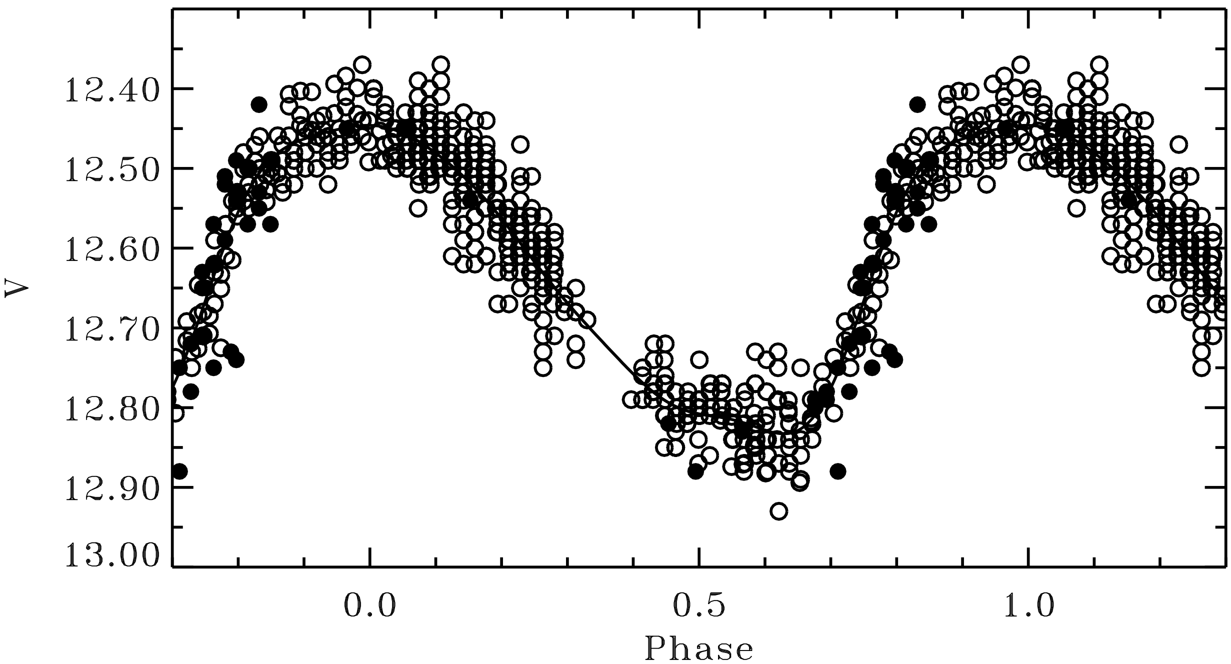

Figure 1. The phase diagram of the BrhV35 assuming that the comparison star GSC 0703-1901 has $V = 12.2$. The CCD observations of Bernhard (filled circles) and Kiyota (open circles) are folded with the ephemeris given in the text, and a high-order Fourier fit over plotted

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WR 140 IN "ECLIPSE" AGAIN

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WR 140 = HD 193793 (WC7 + O4-5) attracted much attention during recent years as a periodic dust maker. Brightenings in the IR in 1977, 1985, and in 1993 were reported by Williams et al. (1978, 1987a, 1987b, 1990) and Williams (1997), and which were attributed to the building of dust grains in the WR 140 wind. The re-occurrence of dust follows exactly the 7.94-yr orbital period and coincides with the periastron passage (PP), where the wind-wind interaction is strongest ($e = 0.84$). In 1993, several months after the PP, it was first observed a dip in the UBV with an amplitude of $\sim 0\overset{\mathrm{m}}{.}03$ (Panov et al. 2000).

The "eclipse" was probably caused by the carbon dust envelope, triggered at the PP by the colliding winds. After 1993, the dust envelope was gradually dispersed and light in UBV gradually increased to reach the "pre-eclipse" level in 1998. Here we present photometry of WR 140 after the recent PP in 2001.14. The observations were taken in June–August, 2001, with the 60-cm telescope and the UBV-photoelectric photometer of the Rozhen National Astronomical Observatory.

In Fig. 1 the differential light curve of WR 140 (comparison star = HD 193888, check star = HD193926) is shown in the sense HD 193888 − WR 140, for the 1991–2000 (squares, Panov et al. 2000) and the 2001 observations (crosses). The June 2001 observations show light minimum with an amplitude of about $0\overset{\mathrm{m}}{.}13$ in V, $0\overset{\mathrm{m}}{.}14$ in B, and $0\overset{\mathrm{m}}{.}20$ in U, much deeper than the "eclipse" at the previous PP in 1993. However, in 1993 we observed WR 140 at orbital phases 0.052–0.06 while in 2001 we were able to cover the phases 0.037–0.068. It is interesting to note, that the June 2001 dust was rapidly dispersed, and the UBV light of WR 140 in July increased and almost reached the "pre-eclipse" level (Fig. 2). The observations in August are consistent with the normal WR 140 light. Thus, the June "dust episode" was very brief, compared to the respective dust grain building in 1993. Fig. 2 shows clearly the difference in the light behaviour in the phase interval 0.055–0.058. The reason for the different photometric behaviour of the dust after the 2001.14 PP is not yet clear.

From the present observations, the deepest light minimum of WR 140 so far observed occurred at orbital phases 0.038–0.046, if we assume a smooth trend of the light curves between these orbital phases. The orbital phases are calculated with $T_0 = 2446160$ (periastron passage) and $P_{\mathrm{orb}} = 2900$ d. Our observations confirm the build-up of dust in the wind of WR 140, probably triggered by the interacting winds of the two stars by the 2001.14 PP.

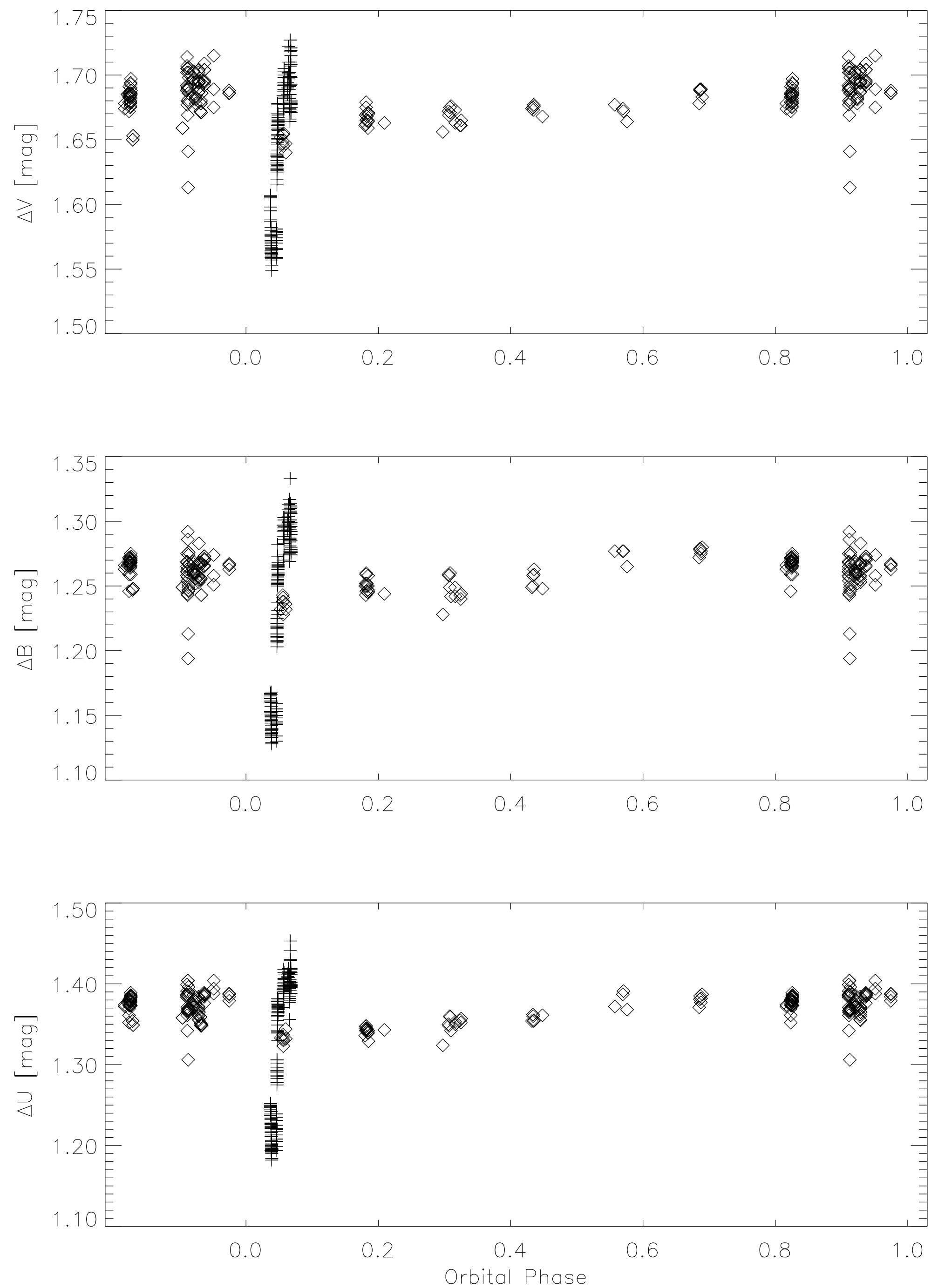

Figure 1. WR 140 light curve for 1991–2001. Squares: observations from 1991–2000. Crosses: 2001 observations

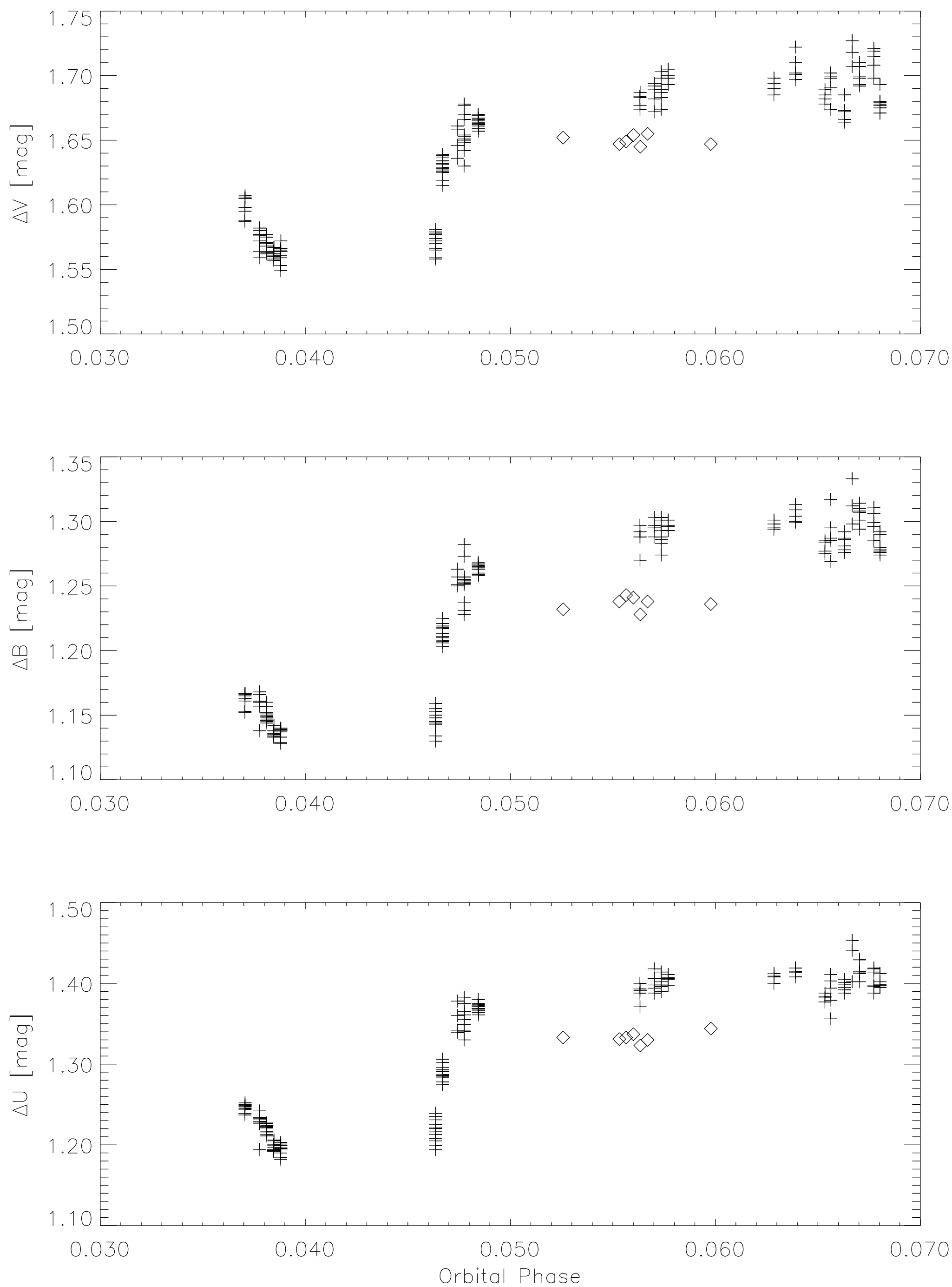

Figure 2. WR 140 light near periastron passages in 1993 (squares) and 2001 (crosses)

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ON THE ORBITAL PERIODS OF TWO BONA-FIDE λ BOOTIS STARS HD 64491 AND HD 141851

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We report about the first estimation of the orbital periods for two apparent spectroscopic binary (SB hereafter) systems: HD 64491 ($V = 6\overset{\mathrm{m}}{.}22$, HR 3083, HIP 38723) and HD 141851 ($V = 5\overset{\mathrm{m}}{.}10$, HR 5895, HIP 77660). Both stars were classified as bona-fide λ Bootis candidates in the literature because at this time they were believed to be apparent single objects. This group is characterized as comprise of late B to early F-type, Population I objects which exhibit a nearly solar abundance of C, N, O and S whereas the Fe-peak elements are significantly sub-solar. There are two SB systems in which both components are true λ Bootis type objects established via a detailed abundance analysis, namely HD 84948 and HD 171948 (Paunzen et al. 1998a).

No detailed abundance analysis which takes the binarity nature into account has been published for our two program stars up to now. Until such an analysis has been done, a question mark has to be set behind the apparent λ Bootis classification. Let us now discuss the two objects in more detail.

HD 64491 was first classified as A9 Vp (λ Boo) by Abt & Morrell (1995) and confirmed as kA3hF0mA3 V (λ Boo) by Paunzen & Gray (1997). Note that Uesugi & Fukuda (1982) give a projected rotational velocity of 75 kms^{-1} whereas Abt & Morrell (1995) list 15 kms^{-1}. Marchetti et al. (2001) performed speckle interferometry for this star and found only an upper limit of 124 mas for the separation of possible components. The first notification of the SB nature for this object is given by Kamp et al. (2001) who investigated high resolution spectra centered at 8670 Å. Paunzen et al. (1998b) reported δ Scuti type pulsation for this object with a period of 71 minutes and an amplitude of 9 mmag in Strömgren b which makes it especially interesting for further studies applying the tools of asteroseismology.

HD 141851 is known as close visual binary with a separation of $0\overset{''}{.}1$ but without data about the luminosity of the components (Faraggiana & Bonifacio 1999). Abt (1984) classified this star as A3 Vnp (Mg wk) whereas Abt & Morrell (1995) and Paunzen et al.

(2001) list A3 Vp (4481 wk) and A2 Va, respectively. Abt & Morrell (1995) give a $v \sin i$ value of 185 kms^{-1}. This system consists probably of a hot and a very cool component since it was identified as a X-ray source by Hünsch et al. (1998). No variability with an upper limit of 4.2 mmag in Strömgren b was found (Paunzen et al. 1998b).

Table 1: The observations for HD 64491 (upper section) and HD 141851 (lower section)

HJD	RV [kms^{-1}]	σ(RV) [kms^{-1}]	Obs.
2450925.6351	+22.2	0.6	KPNO; 0.9 m; Coudé
2451238.4985	+6.3	0.8	BNAO; 2.0 m; Coudé
2451238.5257	+7.5	0.7	BNAO
2451888.5126	+40.2	0.7	BNAO
2451891.4220	+36.1	1.1	BNAO
2451913.3713	+22.3	1.2	BNAO
2451914.4005	+19.6	0.8	BNAO
2451920.4512	+22.6	0.6	BNAO
2451921.3880	+21.5	0.7	BNAO
2451971.3864	+11.9	0.9	BNAO
2451973.3791	+12.6	0.6	BNAO
2451977.2216	+11.7	1.0	BNAO
2452003.2919	+7.4	0.8	BNAO
2452004.2442	+8.9	0.8	BNAO
2452152.5931	+15.4	0.7	BNAO
2449885.5946	−95	7	LNA; 1.6 m, Coudé
2449885.5946	−115	15	LNA
2450495.6312	−26	10	ASIAGO; 1.8 m, Echelle
2450664.4413	−39	5	CASLEO; 2.15 m, Echelle
2451234.5377	−10	3	BNAO
2451236.4845	−8	3	BNAO
2451238.5538	−12	3	BNAO
2451284.4546	−17	3	BNAO
2451296.4247	−20	5	BNAO
2451307.4360	−19	4	BNAO
2452003.4438	−12	2	BNAO
2452069.3324	−9	2	BNAO
2452090.2856	−7	3	BNAO
2452123.2754	−9	2	BNAO
2452150.2469	−9	2	BNAO

Table 1 lists the Heliocentric Julian Dates, the average radial velocity, its mean error and the observatories where the measurements were done. The average radial velocities were calculated from individual measurements of several lines with the correction for the mean heliocentric velocity. The errors are much larger for HD 141851 than for the moderate rotator HD 66491 because there is one hot, fast rotating, component superposed with a very cool slow rotating one with very weak lines in the used spectral domain (mainly the Na D doublet). Figure 1 shows the measurements graphically.

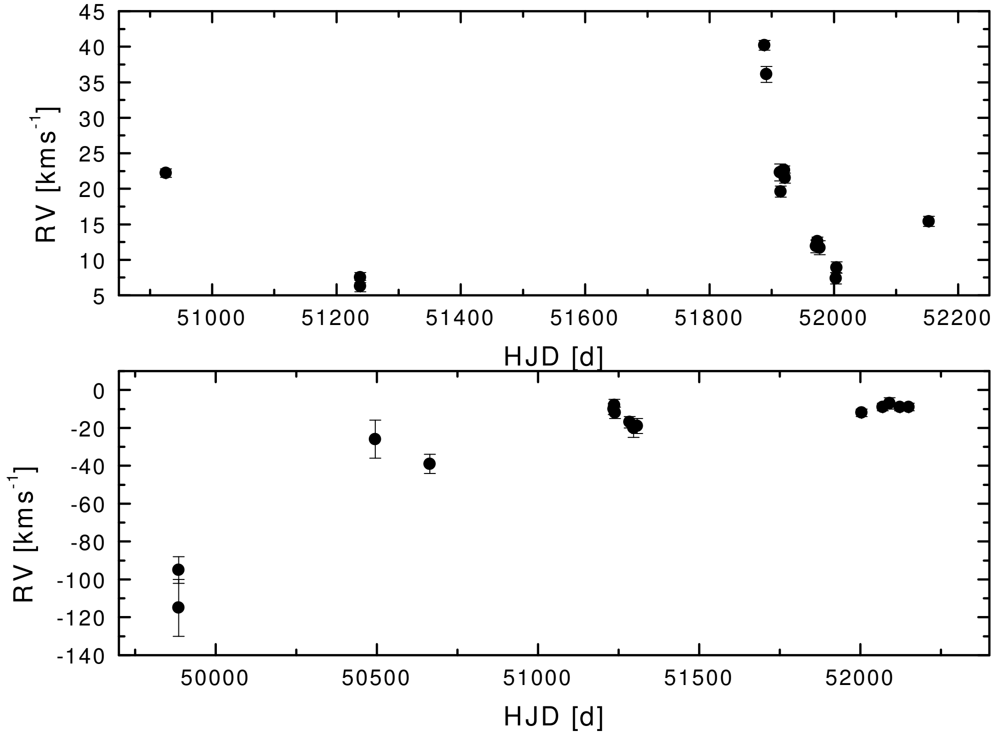

Figure 1. The radial velocity curves for HD 64491 (upper panel) and HD 141851 (lower panel) as listed in Table 1

Due to the temporal distribution of our observations, classical time series algorithm such as Fourier techniques, sine fits or the Phase-Dispersion-Minimization does not result in a reasonable solution. From an examination of Table 1 we are able to conclude that the orbital period for HD 64491 is between 230 days (taking the measurements at HJD 2451888.5126 and 2452003.2919 as half the period) and 760 days (taking the two "minima" at HJD 2451238.4985 and 2452003.2919 as hypothetical real period).

The orbital period for HD 141851 is significant longer than the time base of our available observations (2265 days). Due to the shape of the radial velocity curve (Figure 1) we think that the period is at least ten times longer than the actual time base of our observations.

Further radial velocity measurements and a detailed abundance analysis for both objects taking into account the binarity are needed to shed more light on the true nature of these systems.

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THE FIRST GROUND-BASED PHOTOMETRIC OBSERVATIONS OF V401 LACERTAE

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The variability of V401 Lac (HIP 109283 = BD +48°3621, $\alpha_{2000} = 22^h08^m21^s.25$, $\delta_{2000} = +49°13'15''.6$) was first discovered by HIPPARCOS (ESA, 1997). The photometric observations of the system by HIPPARCOS show an Algol type light curve with an amplitude of $0^m.230$ ranging from $7^m.932$ to $8^m.162$ in V. The mean orbital period derived by HIPPARCOS from the best light curve fit is $1^d.95010$ and the epoch is given as JD 2448501.7900 (ESA, 1997). The spectral type of the system is given as A0.

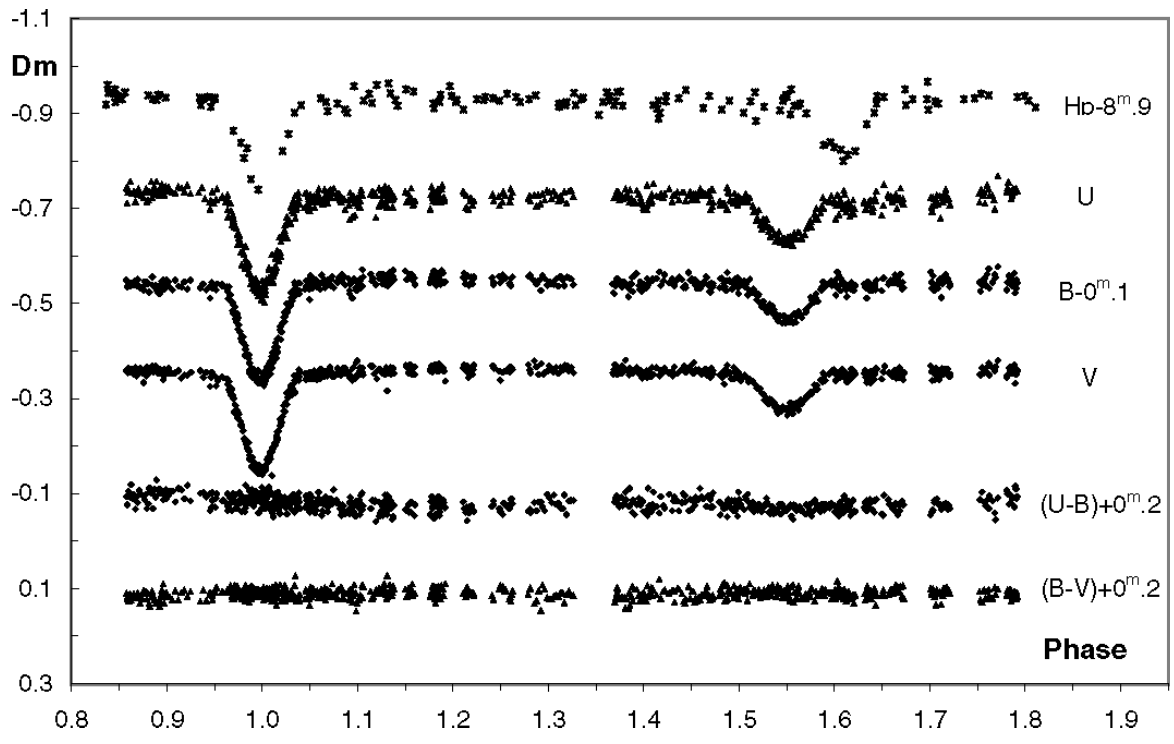

Figure 1. The light and color curves of V401 Lac

The first ground-based photometric observations of V401 Lac were made on 17 nights during 2000 and 2001 observing seasons with a 40-cm Cassegrain telescope at the TÜBİTAK (Scientific and Technical Research Council of Turkey) National Observatory. The

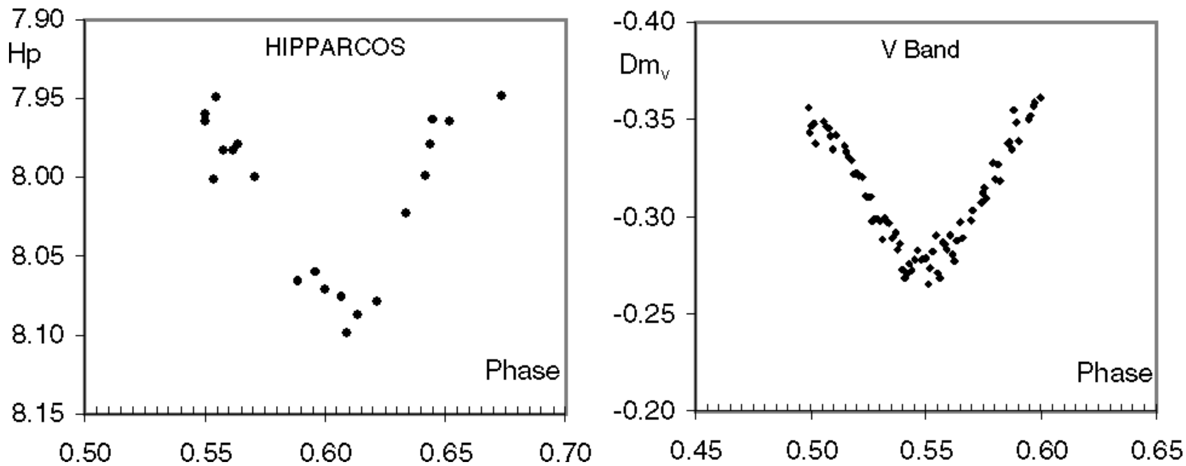

Figure 2. Expanded view around the secondary eclipses

observations were secured by using a single channel OPTEC SSP-5A photometer head which contains a side on R-4457 (PMT) Hamamatsu photomultiplier and UBV filter set close to the standard system. Differential observations, in the sense variable minus comparison, were corrected for the atmospheric extinction and the light time effect. The comparison star is BD +48°3613 (HIP 109026), and the check stars are BD +44°4041 (HIP 209932). The standard errors of our observations are about $0\overset{m}{.}014$, $0\overset{m}{.}011$, and $0\overset{m}{.}008$ in U, B and V filters, respectively.

The light and color curves were plotted in Figure 1 together with the HIPPARCOS light curve. New light curves show that the depths of the eclipses are remarkably different. The estimated values are $0\overset{m}{.}216$ and $0\overset{m}{.}089$ for the primary and the secondary minima respectively. The enlarged eclipse light curve reveal that the duration of the primary and secondary eclipses are about 3.76 and 4.28 hours. It means that the primary eclipse occurs relatively closer to periastron. The position of secondary minimum shifts towards decreasing phases (Fig. 2). About 0.06 phase shift of the secondary minimum in nine years between HIPPARCOS and our observations gives the first estimate of about 150 yr for the apsidal motion period of V401 Lac. The system seems to be a good candidate of eclipsing binary with apsidal motion. Therefore further observations of the system are needed in finding the apsidal motion parameters.

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THE CHANGING AMPLITUDE OF THE δ SCUTI STAR AN Lyn

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The δ Scuti variable AN Lyn was discovered by Yamasaki et al. (1981) and has been the subject of several subsequent investigations (Rodriguez et al. 1997b and references therein). Earlier studies have shown that AN Lyn exhibits a single dominant frequency, which Rodriguez et al. (1997a,b) found to be 10.1756 c/d. Rodriguez et al. (1997b) identified additional frequencies of 18.1309 c/d and 9.5598 c/d, though both of these had amplitudes much smaller than that of the 10.1756 c/d frequency. Rodriguez et al. (1997a,b) reported that the amplitude of AN Lyn declined between the early 1980s and mid 1990s. However, Zhou (2001) recently reported that the amplitude increased between 1994 and 2000.

We obtained CCD photometry of AN Lyn on nine nights between JD 2451989 and JD 2452042. All observations were obtained with an Apogee AP7 CCD on the 60-cm telescope of the Michigan State University Observatory. Differential photometry in the Johnson V passband was secured relative to GSC 02990-00019. This star was also used as a comparison star by Yamasaki et al. (1981), who determined its magnitude to be $V = 11\overset{\mathrm{m}}{.}01$. The Tycho system V magnitude is listed as $10\overset{\mathrm{m}}{.}97$. A second, fainter, star was used to check the nightly variability of GSC 02990-00019, but was not used in obtaining the AN Lyn photometry.

We performed a period search on the 738 data points using a discrete Fourier transform. The best single frequency (f_1) was found to be 10.1739 ± 0.0002 c/d, close to, but smaller than, the previously determined strongest frequency. A fit to the light curve using a frequency of 10.1739 c/d and its first five higher harmonics produced residuals with a standard deviation of $0\overset{\mathrm{m}}{.}012$, comparable to the uncertainty expected from our photometry. The data were prewhitened to remove the 10.1739 c/d frequency and its harmonics, and the period search was repeated. There was no clear evidence for a secondary frequency, but frequencies with amplitudes as small as those of the secondary frequencies reported by Rodriguez et al. (1997b) might not have been detected. The differential light curve of AN Lyn is shown in Figure 1. The V amplitude of the f_1 term is 0.092 ± 0.001 mag.

These observations confirm Zhou's result that the amplitude of AN Lyn has been increasing. V amplitudes of the f_1 frequency of AN Lyn are plotted in Figure 2. Amplitudes for 1996 and earlier years are taken from Table 3 of Rodriguez et al. (1997b). The amplitude for 2000 is taken from Zhou (2001), while the amplitude for 2001 is based upon

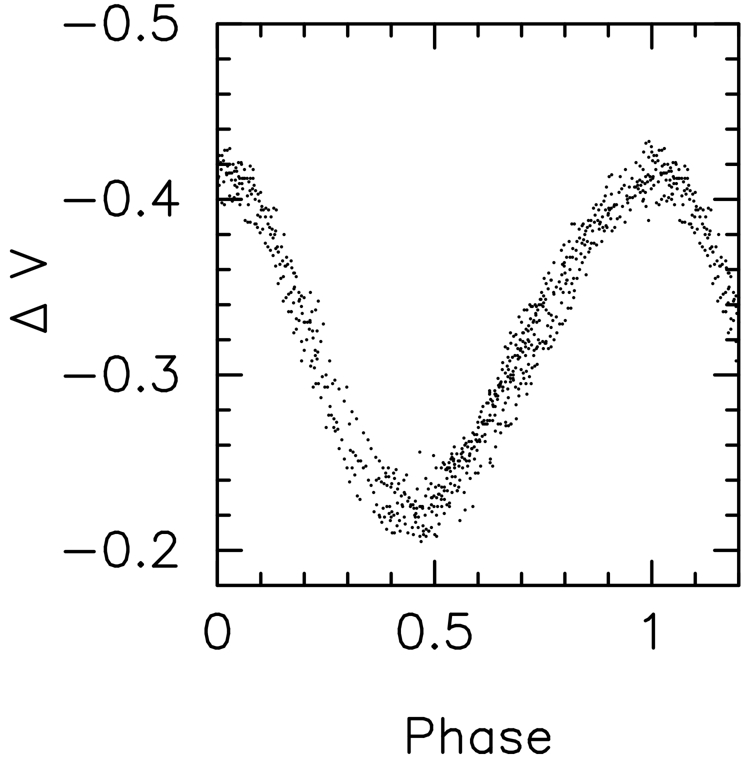

Figure 1. Light Curve of AN Lyn folded with a frequency of 10.1739 c/d

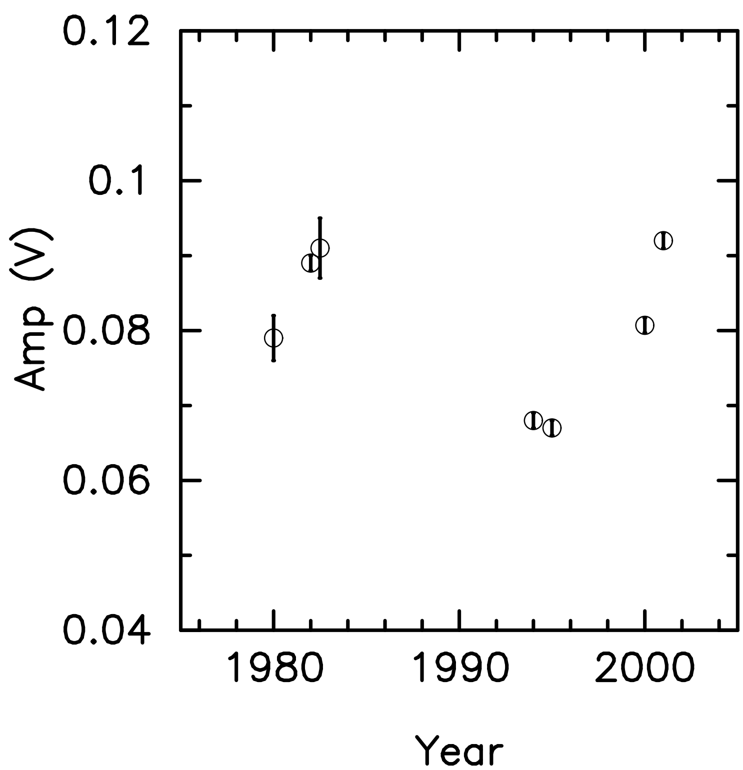

Figure 2. Amplitude of the f_1 frequency. Vertical lines indicate error bars

the observations reported here. Further observations are needed to discover whether the increase in amplitude continues.

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NEW VARIABLE STARS ALONG THE NORTHERN MILKY WAY

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This report summarizes the results of a variable-star search in the $20^\circ \times 15^\circ$ area centered at $21^h22^m/+30^\circ$ (1950). This is a continuation of the series covering a broad region of the northern Milky Way. The basic procedures involved are the same as in previous reports (see *e.g.* Dahlmark 2000).

The light curves were prepared from the following photographic materials. Seventeen yellow/blue plate-pairs (Kodak 103a-D + GG11 filter and 103a-O unfiltered) were exposed between 1967 and 1982. In addition thirty-three films (Kodak TechPan 4415 + GG495 filter) were taken in the years 1992–2001. Three exposures with a 20-cm $f/1.5$ Schmidt camera taken between 1995 and 1997 were examined and used to prepare finder charts. Ten plate- or film-pairs were scanned for variables with a blink comparator and with four stereo comparators used in tandem. Magnitudes were determined in a stereomicroscope using comparison stars taken from the Guide Star Catalogue (Lasker *et al.* 1990). The yellow-light magnitudes 'm_v' shown in Table 2 are thus tied to the GSC (northern) magnitude scale and will be systematically somewhat brighter than standard Johnson V.

In this field fifty-four new variables were found. Table 1 shows identifications and the best available positions for the new stars. The coordinates were drawn, in descending order of preference, from the 2MASS point-source catalogue (second release, Skrutskie *et al.* 2000), GSC-ACT (Gray 1999), USNO–A2.0 (Monet *et al.* 1998), or the recent GSC-2.2 (STScI 2001). One star is bright enough to appear in Tycho-2 (Høg *et al.* 2000). LD 385 is one of a close pair whose position was estimated ($\pm 2''$) on the Digitized Sky Survey via the Goddard SkyView utility. The source of the positions is coded in column 's' of Table 1 as follows: A = USNO–A2.0, G = GSC-ACT, g = GSC-2.2, M = 2MASS, S = SkyView, T = Tycho-2. The MSX catalogue (Price *et al.* 2001) was a useful aid in identifying some of the stars. MSX identifications are made for objects not appearing in the IRAS catalogues. The final column gives other identifications from SIMBAD and external catalogues that match in position and object type. 'DO' numbers refer to the Dearborn red stars catalogue (Lee *et al.* 1947), with spectral types quoted in parentheses; 'CGCS' numbers are from the second Stephenson carbon-star catalogue (Stephenson 1989).

LD 402 was identified as V1904 Cyg after the observations were completed. The period determined here is similar to that found by Zemliannikova (1986). Several stars have been independently reported as variable by other amateur observers. Among these LD 383 = Had V18 = V422 Vul was named on a recent GCVS name-list. For most of the remainder usually only a few observations have been previously available.

Table 1: Positions and identifications

Name	RA (2000)	Dec	s	GSC	IRAS	Other IDs
LD 367*	20 34 45.85	+32 48 13.2	G	2690-1071	20327+3237	
LD 368	20 37 00.15	+33 54 08.9	M		20350+3343	
LD 369	20 37 01.19	+30 39 45.6	M		20349+3029	
LD 370	20 37 11.25	+34 22 14.6	M		20352+3411	
LD 371*	20 38 19.81	+34 12 20.7	M		20363+3401	[PCC93] 420
LD 372*	20 39 01.13	+27 29 33.1	A			
LD 373	20 39 50.10	+34 37 18.0	G	2694-2096	20378+3426	
LD 374	20 43 00.54	+33 24 43.6	M		20409+3313	
LD 375*	20 43 21.11	+26 24 36.8	g			
LD 376	20 44 12.47	+26 12 46.3	A		20420+2601	
LD 377	20 45 01.24	+27 15 07.3	A			
LD 378	20 49 05.91	+23 21 51.9	M			
LD 379	20 53 09.51	+32 31 04.8	g			
LD 380*	21 01 29.92	+25 03 42.6	G	2176-1341	20593+2451	
LD 381	21 04 05.56	+26 32 11.1	M		21019+2620	
LD 382	21 04 05.52	+32 30 13.2	M	2705-0784		
LD 383*	21 05 11.04	+26 54 14.5	A		21030+2642	V422 Vul
LD 384	21 05 32.23	+35 25 05.9	M	2709-2776		
LD 385*	21 07 55.6	+35 35 21	S			
LD 386*	21 08 01.30	+23 43 44.6	G	2173-0719	21057+2331	StM 536
LD 387	21 09 01.23	+27 31 23.2	T	2181-1309	21068+2719	DO 20055 (M6)
LD 388*	21 10 14.82	+31 29 40.7	M		21081+3117	
LD 389*	21 10 19.33	+33 28 53.8	M			
LD 390*	21 10 47.76	+34 20 06.4	M		21087+3407	
LD 391*	21 11 13.60	+34 19 14.3	M			
LD 392*	21 11 19.97	+31 23 19.1	G	2702-0676	21092+3111	
LD 393	21 13 43.61	+28 00 13.9	G	2194-2252	21115+2747	
LD 394*	21 14 12.26	+36 39 00.0	g			[D75] 130 (M7)
LD 395	21 16 45.00	+29 13 39.5	G	2198-1085	F21145+2900	
LD 396	21 17 09.56	+31 07 49.9	M	2702-1537	21150+3055	
LD 397	21 18 34.71	+33 44 30.8	M			
LD 398	21 19 39.94	+35 00 11.1	M	2711-0059		
LD 399	21 19 53.00	+35 08 57.9	M	2711-0433		
LD 400	21 20 19.48	+28 08 57.6	M			
LD 401	21 20 31.92	+33 07 17.6	M	2707-1462		CGCS 5254 = DO 20294
LD 402*	21 24 43.63	+33 59 17.3	M			V1904 Cyg
LD 403*	21 25 18.84	+27 03 25.8	G	2195-1274		
LD 404	21 25 27.63	+22 25 42.1	G	1675-1355	21231+2212	
LD 405	21 29 55.82	+23 13 05.9	G	2188-0931		
LD 406	21 31 17.65	+26 44 06.4	A		21290+2630	
LD 407	21 31 54.64	+33 03 02.8	M	2708-1539		MSX G081.7116–13.4145
LD 408	21 35 09.76	+31 11 35.9	M	2704-0321		MSX G080.8816–15.2254
LD 409	21 36 04.16	+36 13 47.0	G	2729-2282		MSX G084.5981–11.7114
LD 410	21 39 32.32	+30 03 51.1	A			MSX G080.7727–16.6915
LD 411	21 39 55.09	+31 19 16.1	A			
LD 412	21 43 00.06	+32 41 38.9	G	2721-1053		MSX G083.2033–15.2747
LD 413	21 43 10.31	+35 45 13.6	G	2729-2394		
LD 414	21 43 35.93	+37 22 34.9	A		21415+3708	
LD 415	21 44 47.46	+34 27 15.3	G	2725-1671	21426+3413	MSX G084.7122–14.2212
LD 416	21 46 09.65	+35 56 16.3	G	2730-0323	21440+3542	
LD 417	21 51 55.43	+29 17 13.3	G	2214-1992		MSX G082.2985–19.0853
LD 418	21 52 58.57	+33 48 29.1	G	2726-1773	F21508+3334	
LD 419	21 59 40.64	+29 39 59.3	G	2215-0401	21574+2925	
LD 420	22 07 09.90	+28 28 37.2	G	2216-1795	F22048+2813	

Notes:

LD 367 northern star of a small trio, GSC position possibly slightly in error.
LD 371 Yoshida (2000c) variable MisV1031.
LD 372 northeastern star of a pair.
LD 375 southeastern star in a tight ($\sim 7''$) line of three. Faint on POSS-I plates (red $\sim 18^{\rm m}$, not present on the blue plate).
LD 380 Yoshida (2000b) variable Mis V0967.
LD 383 Haseda (1999) variable Had V18, GCVS designation assigned in 76th name-list (Kazarovets *et al.* 2001).
LD 385 southwestern star of a pair.
LD 386 Collins (2000) variable Q1991/78.
LD 388 Wakuda variable 34.
LD 389 Hiraga variable Hrm V_J211021+332912.
LD 390 Collins (2000) variable Q2000/247.
LD 391 not red: 2MASS $J-K=0.3$.
LD 392 Yoshida (2000a) variable Mis V0768.
LD 394 Hiraga variable Hrm V_J211412+363905; southeastern star of a close pair.
LD 402 GCVS identification confirmed on chart in Zemliannikova (1986).
LD 403 faint companion on south.

Table 2: Elements of variation

Name	max (m_v)	min	$b-r$	type	epoch JD 2400000+	period (days)
LD 367	11.3	13.3		SR	50765	302
LD 368	13.0	16.0		M	51895	433:
LD 369	12.1	15.0	4.3	M	51109	402
LD 370	12.4	14.5	6.3	SRa	51867	400
LD 371	13.4	>16.0		I		
LD 372	13.3	15.0	3.9	SRa	50637	359:
LD 373	11.8	13.2	2.9	Lb		
LD 374	13.7	>16.0		I		
LD 375	12.5	>14.8	4.4	SRa	51432	392
LD 376	12.0	15.8	4.6	M	51432	347
LD 377*	12.5	>16.0	2.8	M	50691	163
LD 378	13.1	>16.0	2.9	SR		
LD 379*	13.2	>16.2	3.2	M	51432	800?
LD 380	12.0	15.0	3.1	M	50637	335
LD 381	12.2	15.0	2.8	M	51513	320
LD 382*	11.0	15.5	2.5	SR	51931	400?
LD 383	10.5	14.9	3.3	M	51867	310
LD 384*	12.8	14.2	2.5	E	51931	<73
LD 385	13.1	14.4		SR	51432	289
LD 386	10.5	14.4	3.7	M	51836	332
LD 387	9.7	11.1	3.3	Lb		
LD 388	11.2	14.3	6.9	SRa	51432	360:
LD 389*	11.3	14.6	3.6	M	50691	280
LD 390	10.4	14.9	2.8	M	51432	382
LD 391	12.5	14.6	0.5	Lb		
LD 392	11.2	>15.0	2.3	M	51461	336
LD 393	11.7	>16.0		M	51895	369
LD 394	10.6	>14.7		M	50637	363
LD 395	12.2	>14.4	2.8	Lb		

Table 2 (cont'd.): Elements of variation

Name	max (m_v)	min (m_v)	$b-r$	type	epoch JD 2400000+	period (days)
LD 396	11.5	15.0	2.5	M	51641	299
LD 397	13.5	15.9	2.3	SRa	51908	240:
LD 398	12.1	13.3	3.5	Ib		
LD 399	11.8	13.3	2.1	Ib		
LD 400	12.4	14.1	2.5	Lb		
LD 401	10.7	13.2	5.1	SRa	51836	387
LD 402*	11.3	>15.0	2.4	M	51867	282:
LD 403	13.3	15.6	2.3	SRa	51931	391
LD 404	11.9	13.4	3.0	SRa		
LD 405	12.0	13.0	2.5	Lb		
LD 406	11.1	>15.0	3.6	M	51432	350
LD 407	11.5	15.6	2.6	M	51895	231
LD 408	12.7	14.8	3.0	SRa	51542	235
LD 409	11.3	12.9	2.7	SR		
LD 410	14.0	15.5	2.5	SRb		
LD 411	12.5	>16.0	2.6	M	50716	746
LD 412	11.4	13.7	2.9	Lb		
LD 413	13.2	15.1	1.5	SR	51836	380
LD 414	12.0	15.0	2.6	SR	51513	404:
LD 415	10.8	>16.0		Lb		
LD 416	11.6	15.2	2.8	M	51513	320
LD 417	11.9	13.5	3.5	Lb		
LD 418	11.6	13.1	1.7	SR		
LD 419	12.0	13.5	2.3	SR		
LD 420	12.0	16.1	2.2	M	51641	195

Notes:

LD 377 mr = 16.8 in USNO-A2.0.

LD 379 period near 608^d from 1967 to 1977, and 800^d from 1995 to 2001.

LD 382 periodicity not always apparent.

LD 384 Six minima observed; the true period is probably some small fraction of the period given. P. Guilbault (priv. comm.) suggests from preliminary observations that the star is continuously variable, and probably of the β Lyr or W UMa type.

LD 389 Hiraga also derives a period of 280^d.

LD 402 Zemliannikova (1986) obtains a period of $290\overset{d}{.}4$.

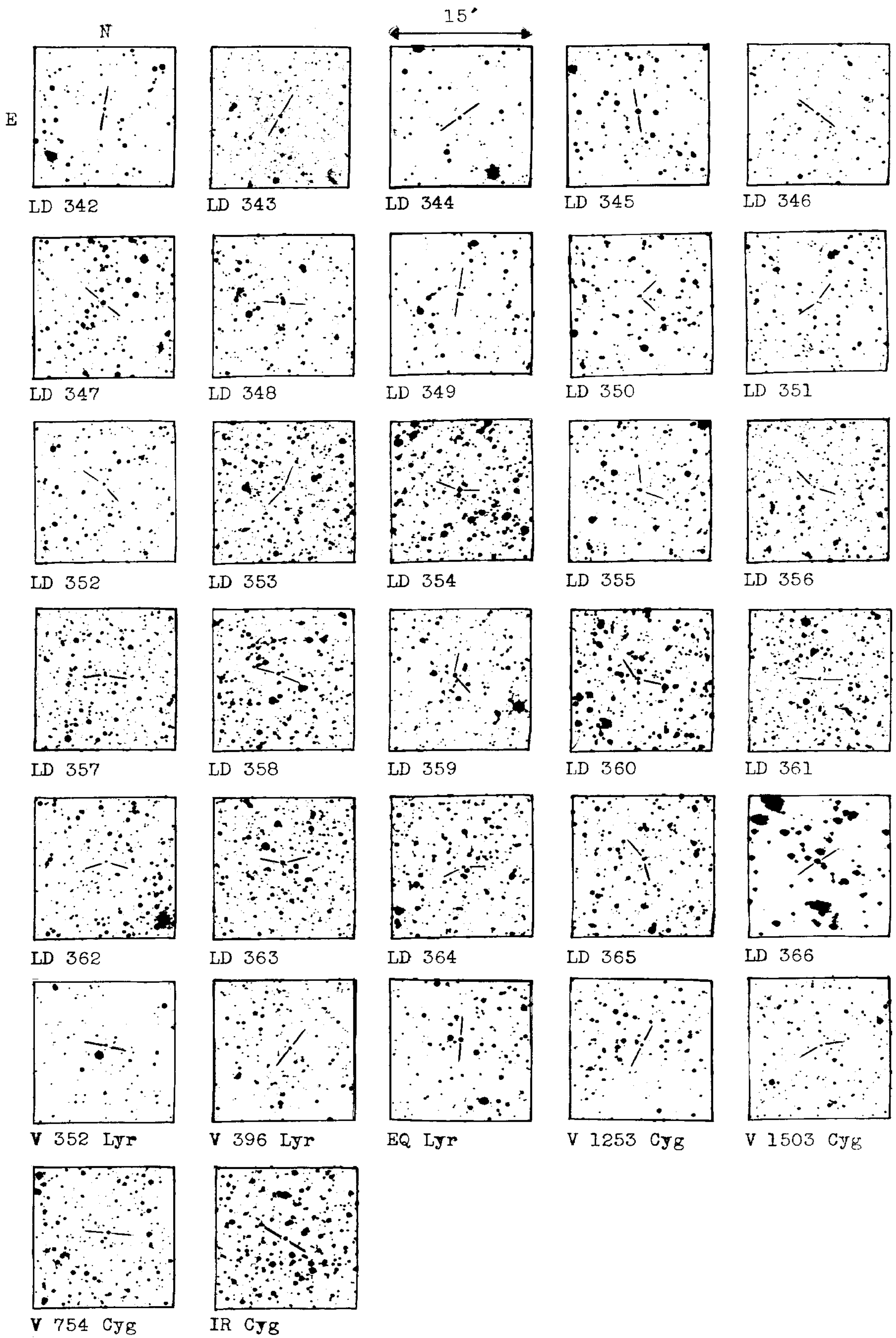
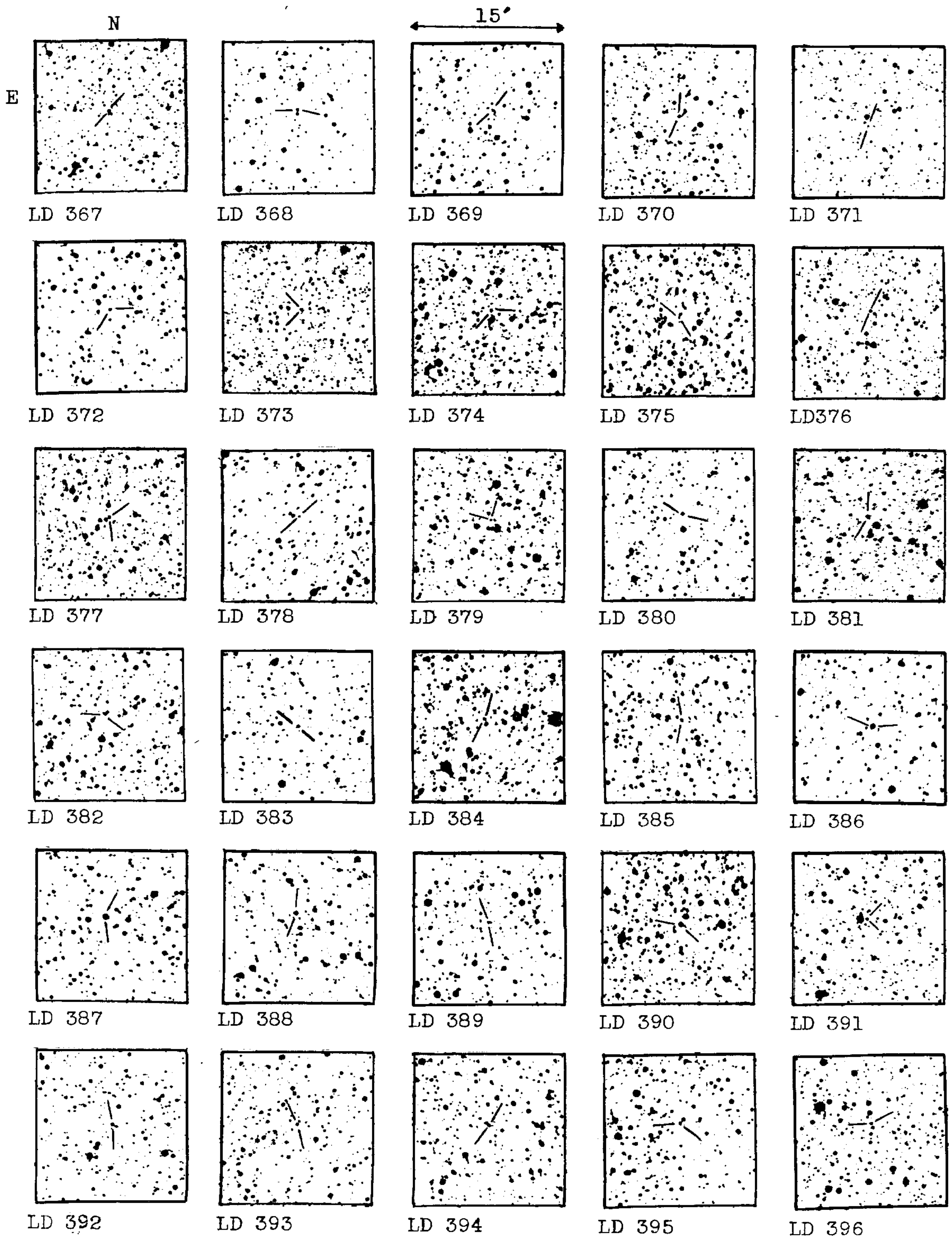

15′
N
E
LD 342
LD 343
LD 344
LD 345
LD 346
LD 347
LD 348
LD 349
LD 350
LD 351
LD 352
LD 353
LD 354
LD 355
LD 356
LD 357
LD 358
LD 359
LD 360
LD 361
LD 362
LD 363
LD 364
LD 365
LD 366
V 352 Lyr
V 396 Lyr
EQ Lyr
V 1253 Cyg
V 1503 Cyg
V 754 Cyg
IR Cyg

Figure 1.


N
E
15′
LD 367
LD 368
LD 369
LD 370
LD 371
LD 372
LD 373
LD 374
LD 375
LD376
LD 377
LD 378
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LD 380
LD 381
LD 382
LD 383
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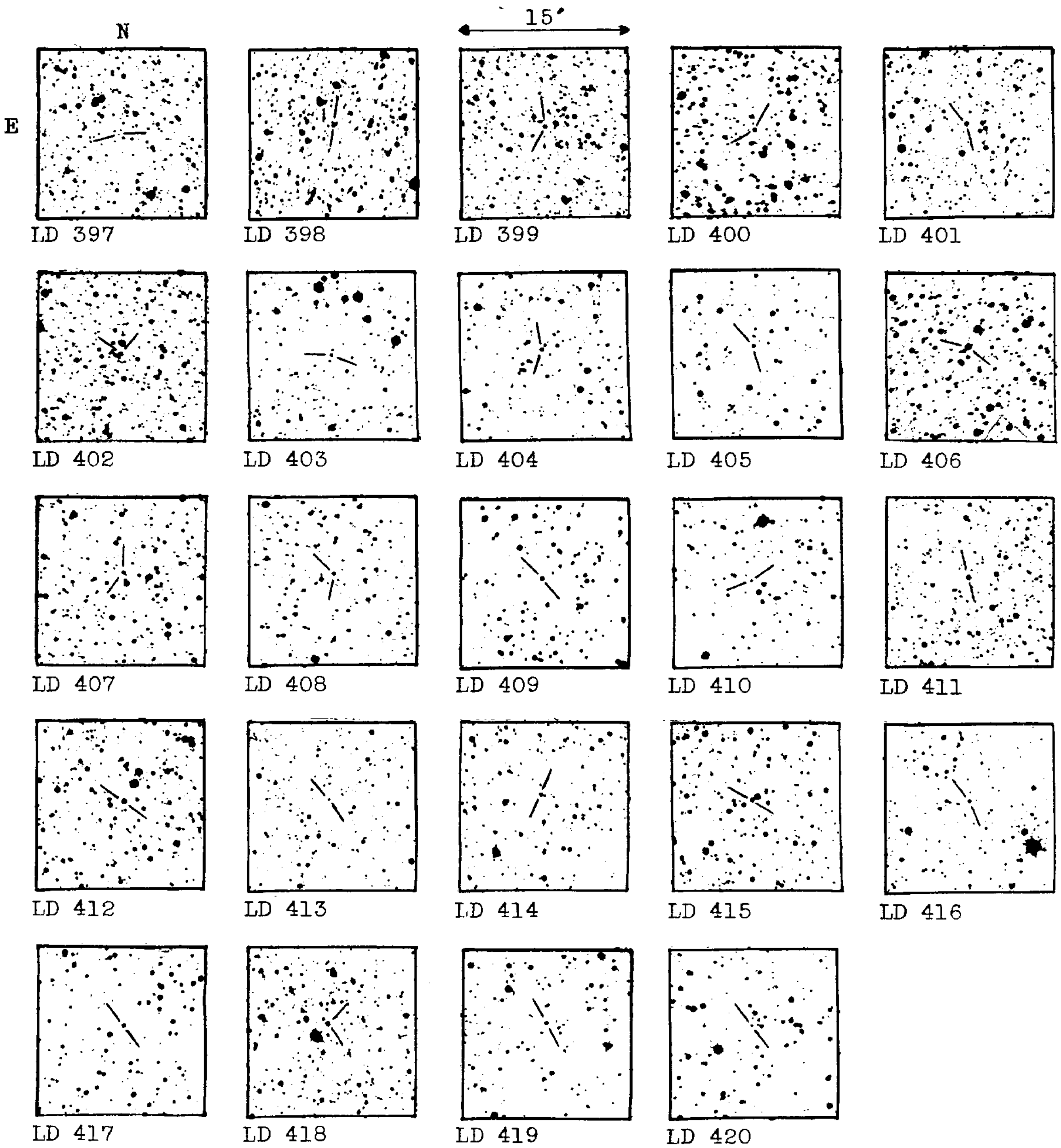
LD 394
LD 395
LD 396

Figure 2.



15′
N
E
LD 397
LD 398
LD 399
LD 400
LD 401
LD 402
LD 403
LD 404
LD 405
LD 406
LD 407
LD 408
LD 409
LD 410
LD 411
LD 412
LD 413
LD 414
LD 415
LD 416
LD 417
LD 418
LD 419
LD 420

Figure 3.

The elements of variation are collected in Table 2. An asterisk by the star name indicates a note following the table. The light curve determinations are based usually on fifty magnitude estimates for each star. From these the magnitude range, provisional variability type, epoch of maximum, and period have been determined. The column '$b-r$' shows star colors from USNO–A2.0; these are not well calibrated to any standard system, but serve to indicate in a qualitative way the sorts of stars involved.

Finder charts (Figs. 1–3) are shown both for stars in the present list and the previous one (LD 342–366), which were inadvertently omitted from Dahlmark (2000).

I would like to thank Gerhard Klaus (Grenchen, Switzerland), who has provided me for many years with finding charts and magnitudes from the GSC for each of the variables. Brian Skiff (Lowell Observatory) has checked the coordinates and identifications, and has prepared the material for publication. All the catalogue searches except in GSC-2.2 were done using the CDS-Strasbourg VizieR utility. Preliminary designations for suspect variables were identified in Taichi Kato's handy 'newvar' list (Kato 2001).

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V, I_C OBSERVATIONS OF THE VARIABLE ANTIPIN V71

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The variable star Antipin V71 was discovered on the Moscow plate collection (Antipin 2000). We crossidentify the object with the star USNO SA2 1500-00018885. The star is given there with $15\overset{m}{.}7$ and $15\overset{m}{.}0$ in the red and the blue passbands, respectively. Accurate astrometry based on a local USNO SA2 frame relative to the surrounding astrometric stars AC2000 451 (= Tycho-2 1053516), AC2000 191 and AC2000 332 (= Tycho-2 1053462) leads to

$$\alpha_{J2000.0} = 00^{h}00^{m}52\overset{s}{.}901 \pm 0\overset{s}{.}025, \qquad \delta_{J2000.0} = 62°25'14''.84 \pm 0''.3.$$

CCD photometry of this rapid variable ($P = 0\overset{d}{.}0865524$, Antipin 2000) was obtained at the Innsbruck 60-cm RC telescope during two runs October 20, 2000 (MJD 51838) and December 5, 2000 (MJD 51884) using Johnson V and Cousins I_C filters. Eight stars, later absolute calibrated as tertiary standards at the end of the second run, were chosen to obtain differential photometry. The exposure time was 200 and 150 seconds in V and I_C, respectively. Due to cirrus clouds on October 20 sometimes the exposure were extended up to 600 seconds in V.

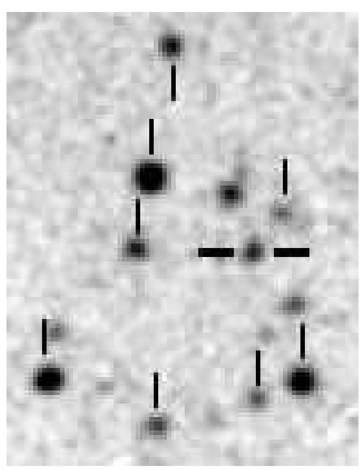

Figure 1. The $2'.8 \times 3'.7$ field around Antipin V71 (thick horizontal bar) and the comparison stars used for the differential photometry (N is up, E is left)

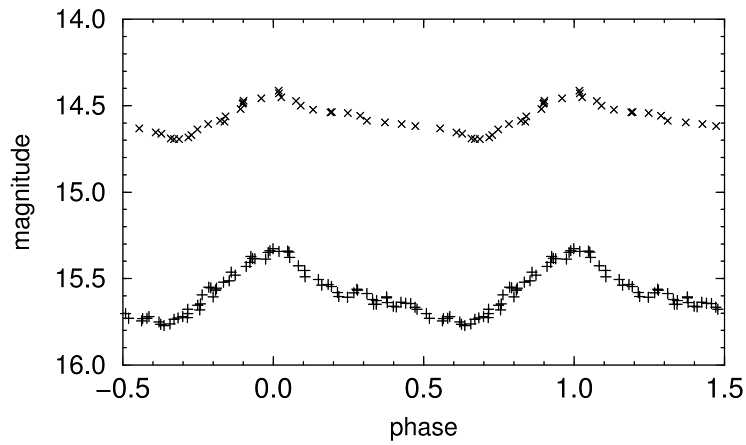

Figure 2. The V (+) and the $I_{\rm C}$ (×) light curve of the target

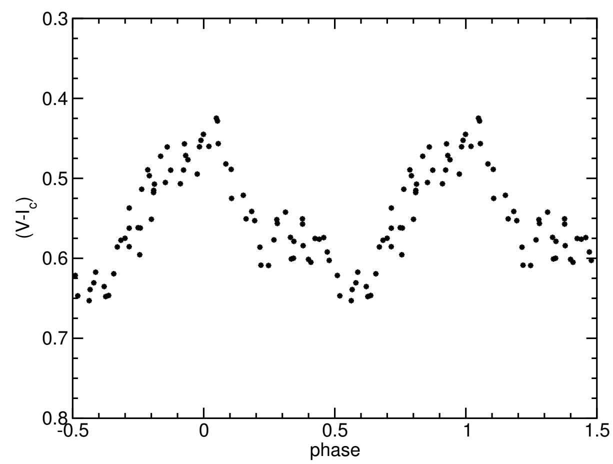

Figure 3. The change of the $V - I_{\rm C}$ color as function of the phase

For the source extraction we used SExtractor (Bertin & Arnouts 1996). The absolute calibration was obtained by 55 frames of the stars HR 670, 7891, 8585, HD 58142 and HD 204414 taken on December 5.

The light curve clearly shows an asymmetrical behavior. We assume Antipin V71 to be a high amplitude δ Sct type star (HADS). There is a slight bump at phase of about 0.3 to 0.5. The light curve does not change during the whole set of observations covering more than 500 pulsations in total. Antipin (2000) obtained a first light curve by using 856 photographic plates obtained in the years 1948 to 1994. Thus he was able to accurately derive the period. We obtained, using the original period, a slightly different phase of maximum light

$$\text{Max.} = \text{HJD } 2441186.458 \pm 0.001 + 0\overset{\rm d}{.}0865524 \times E.$$

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SPECTROSCOPY AND PHOTOMETRY OF V1137 Aql

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V1137 Aql = SON 8114 was discovered by Hoffmeister (1964), who detected its brightness variations between $m_{\rm pg} = 14\overset{\rm m}{.}5$ and $16\overset{\rm m}{.}5$. The variability type SR: was assigned to the object in the General Catalogue of Variable Stars (Kholopov et al., 1985). The star was detected by several satellite infrared (IR) surveys (RAFGL 2413, Price & Murdock, 1983; IRAS 19307+1338; MSX5C–G049.8933–02.7331, Egan et al., 1999), which revealed a strong IR flux and emission features at 9.7 and 18 μm, indicative of the circumstellar silicate dust. Ground-based IR photometry and spectroscopy (Joyce et al., 1977; Lebofsky et al., 1978; Eiroa et al., 1983) showed that the object's fluxes were significantly variable.

From $BVRI$ photometry Eiroa (1981) concluded that V1137 Aql is a heavily reddened M1-type star (see Table 1), and calculated possible distance (D) and overall, inter- and circumstellar, extinction (A_V) toward it: $A_V = 5\overset{\rm m}{.}05$ and $D = 313$ pc for the luminosity type III and $A_V = 4\overset{\rm m}{.}68$ and $D = 6.2$ kpc for Ia. Radio observations by Josselin et al. (1998) resulted in a detection of the CO line emission with a ratio $R = S_{60}/T_{\rm mb} = 293$ Jy K^{-1} (where S_{60} is the 60-μm IRAS flux and $T_{\rm mb}$ is the brightness temperature of the CO (1–0) transition). These authors suggested that the latter result indicate that V1137 Aql was a supergiant, because less luminous post AGB stars have $R \leq 150$.

However despite the extensive information from the IR region, optical observations of V1137 Aql are still represented by photographic photometry (Gessner, 1983, 1986) and the BVRI data (Eiroa, 1981). This allows only rough and indirect estimates of the star's physical parameters and evolutionary state. In order to fill this gap we present the results of our multicolor photometry and low-resolution optical spectroscopy of V1137 Aql.

The $BVRIJHK$ observations in the Johnson photometric system were obtained between July 1986 and August 1995 at two 1-meter telescopes of the Fesenkov Astrophysical Institute (Kazakhstan) with a two-channel photometer-polarimeter of the Pulkovo Observatory (Bergner et al., 1988a). The results are presented in Table 1. The large difference in $R - I$ between our data and those of Eiroa (1981) can be explained by the very red color of the object, differences in the instrumental photometric systems, and intrinsic variability of the star. The detected variations are $\sim 1^{\rm m}$ in the VRI-bands, while the B-magnitude varies between $14\overset{\rm m}{.}5$ and $15\overset{\rm m}{.}9$ (similar to the results of Hoffmeister, 1964).

Two spectra of V1137 Aql (reciprocal dispersion 50 Å mm^{-1}, resolution 2.1 Å) were obtained on 1991 July 20 (4235–5245 Å) and July 21 (5981–7013 Å) at the 6-meter telescope of the Russian Academy of Sciences with a TV-scanner mounted in the Nasmyth

Table 1: Photometric data on V1137 Aql = CRL 2413[a]

Date	JD 2440000 +	$B-V$	V	$V-R$	$V-I$	$V-J$	$V-H$	$V-K$
/07/78	[b]	3.21	12.03	2.59	4.83	–	–	–
02/07/86	6614.23	3.16	11.33	2.59	4.26	5.74	–	–
13/09/89	7783.19	3.29	11.57	2.61	4.32	5.76	6.75	7.33
16/09/89	7786.18	3.45	11.55	2.55	4.30	5.74	6.69	7.34
27/08/91	8496.16	–	11.95	2.61	4.29	–	–	–
07/11/92	8934.05	3.57	12.28	2.77	4.36	–	–	–
12/08/95	9942.31	3.16	11.83	2.44	3.99	5.76	6.77	7.47

[a] The mean errors (including those of translation from the instrumental to the standard photometric system) are as follows: $0\overset{\mathrm{m}}{.}02$ in $R-I$, $0\overset{\mathrm{m}}{.}03$ in $V-R$, $V-K$, and the V-band, $0\overset{\mathrm{m}}{.}05$ in $B-V$, $V-J$, and $V-H$.

[b] The errors are $0\overset{\mathrm{m}}{.}01$ in the V-band and $0\overset{\mathrm{m}}{.}02$ in the color-indices (Eiroa, 1981).

Table 2: Intensities of the TiO bands in the spectrum of V1137 Aql

Band	4626	4669	4761	4804	4893	4955	5167	6158
$I_{\min}/I_{\max}$	0.67	0.62	0.58	0.81	0.69	0.66	0.44	0.75

focus. Its most prominent features are TiO bands (see Table 2), whose intensities we measured using the technique by Boyarchuk (1969). We also detected Balmer lines in absorption, many strong metallic lines, and no obvious emission lines.

The TiO band strengths were compared with those of M stars with known spectral types from Boyarchuk (1969), who used dispersions of 61 and 80 Å mm^{-1}. The resulting spectral type is M2-3. The spectrum of μ Cep (M2 I), obtained at the Ritter Observatory with a 0.25 Å resolution, turned out to be similar to our red spectrum of V1137 Aql, except for the Hα line which can be partly filled in by an emission component (Fig. 1, left panel). We also compared the blue part of the object's spectrum with that of AS 501 (M4-5 I-II, Bergner et al., 1988b), which we obtained on 1991 July 20 at the 6-meter telescope with the same equipment. The luminosity dependent intensity ratios of the Fe I lines at 4376, 4383, and 4389 Å and at 4427 and 4431 Å indicate that V1137 Aql is less luminous than AS 501. Thus, our spectroscopic data suggest an MK type of M2/3 II-III for V1137 Aql.

Our photometry supported by the longer-wavelength data indicate that V1137 Aql is surrounded by a large amount of circumstellar dust, whose characteristics can be derived by modelling the observed spectral energy distribution (SED). The IR data obtained by different authors show that the object's flux at 11 μm varies from 46 Jy (Joyce et al., 1977) to 195 Jy (Price & Murdock, 1983). This is comparable with the amplitude of the optical variations. The IRAS and MSX data, which represent an intermediate brightness level, were used along with the averaged optical data to construct the SED. Despite the uncertainty in the IR fluxes, its shape is better determined, which is seen from our photometric data. To calculate theoretical SEDs, we used a radiative transfer code DUSTY by Ivezić, Nenkova, & Elitzur (1999) for spherical dusty envelopes. The dust temperature distribution is calculated self-consistently including dust scattering, absorption, and emission. A Kurucz (1994) model for $T_{\text{eff}} = 3750$ K and $\log g = 1.0$, roughly corresponding to an M2/3 III star, was used to describe radiation of the star and

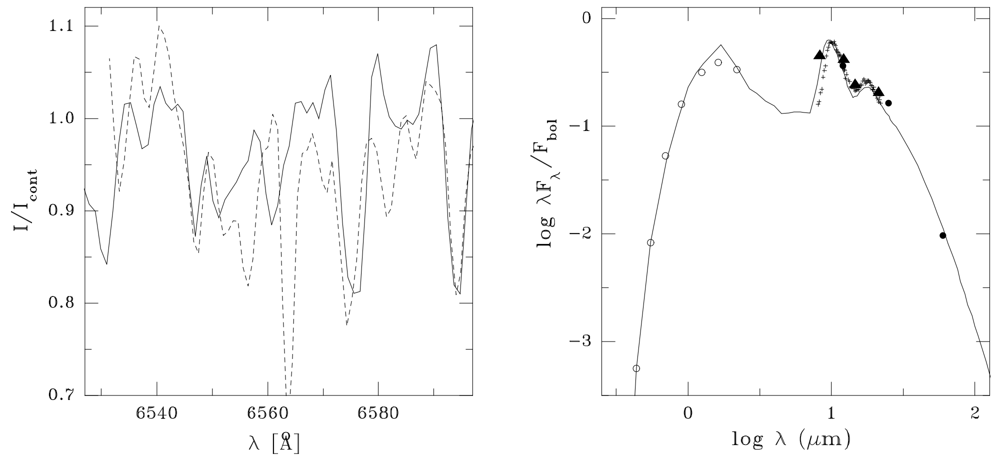

Figure 1. Left panel. A part of the spectrum of V1137 Aql near the Hα line (solid line). The dashed line represents the spectrum of μ Cep obtained at the 1-meter telescope of the Ritter Observatory of the University of Toledo with a fiber-fed échelle spectrograph and a Wright Instruments Ltd. CCD camera (the resolution is 0.2 Å) and re-binned to a constant wavelength increment of 2 Å. Both spectra are normalized to the continuum level near the Hα line. The wavelengths are in Å. **Right panel.** The averaged observed and dereddened SED of V1137 Aql and a theoretical model (solid line) calculated with the parameters described in text. Our optical and near-IR data are shown by filled circles, the MSX fluxes by filled triangles, the IRAS fluxes by filled squares, and the IRAS low-resolution spectrum by pluses

optical properties of the interstellar dust (Mathis, Rumpl, & Nordsieck, 1977) to model dust particles in the envelope. Models with different dust sublimation temperatures ($T_{\rm sub}$), the envelope optical depths at 0.55 μm (τ_V), and ratios of its outer and inner radii ($Y_{\rm out}$) were calculated. The dust density distribution $\propto r^{-2}$ (where r is the distance from the star) was fixed. We compared the observed and theoretical SEDs adjusting the interstellar extinction $A_V^{\rm IS}$ with the best fit shown in the right panel of Fig. 1.

The modelling shows that the strengths of the silicate features are well reproduced by the interstellar dust with $\tau_V = 5.2$, while $A_V^{\rm IS} \simeq 0\overset{\rm m}{.}1$–$0\overset{\rm m}{.}2$. $T_{\rm sub}$ of 500–600 K is required to match the near-IR part of the SED and $Y_{out} \sim 100$ to match its slope at $\lambda \geq 25$ μm. However, the combination of the satellite IR and our data, obtained non–simultaneously, make the relative contribution of the circum- and interstellar extinction uncertain. Since the observed near-IR color-indices are not consistent with a large $A_V^{\rm IS}$, we do not expect it to be $\geq 1^{\rm m}$. The observed $J-H = 1\overset{\rm m}{.}02 \pm 0\overset{\rm m}{.}03$, which is lightly affected by the thermal radiation, and intrinsic $(J-H)_0 = 0\overset{\rm m}{.}88$ (Bessell & Brett, 1988) suggest $A_V^{\rm IS} \leq 1\overset{\rm m}{.}2$.

The results of our calculations suggest that the dusty envelope around V1137 Aql is optically thin in the IR but optically thick in the optical domain. Using the bolometric flux ($F_{\rm bol}$) and a relation of $A_V^{\rm IS}$ versus D in the object's direction, we can estimate its luminosity. $F_{\rm bol}$, calculated from the theoretical SED scaled with the observed fluxes, is 5×10^{-5} W m^{-2} and is uncertain within at least a factor of 2. Eiroa (1981) estimated $A_V^{\rm IS} \sim 3^{\rm m}$ at $D \geq 1$ kpc in this direction. Miroshnichenko (1996) studied the interstellar extinction law in a region of $\sim 2°$ around MWC 314, located in $\sim 3°$ from V1137 Aql, and showed that $A_V^{\rm IS}$ reaches $\sim 1^{\rm m}$ at $D \sim 1$ kpc. Since $F_{\rm bol} = \sigma T_*^4 \left(\frac{R_*}{D}\right)^2$, where R_* is the star's radius, at $D = 1$ kpc $M_{\rm bol} = -3\overset{\rm m}{.}2$ and is close to that of the luminosity type III (Straižys & Kurilene, 1981). It corresponds to $R_* \sim 90$ $R_\odot$ and is consistent with recent estimates for normal M3-type giants by Dumm & Schild (1998).

Thus, we conclude that V1137 Aql is an intermediate-luminosity oxygen-rich early M-type star showing brightness variations similar to those of the Mira stars. This is consistent with its location in a region of optical Mira variables in the IRAS color–color diagram (Olnon et al., 1984). Our luminosity estimate implies a main sequence mass of $\sim 1\ M_{\odot}$ and a possible period of the variations of $\sim 100^{\rm d}$–$150^{\rm d}$(Wood et al., 1983). The results of our study can be verified by follow up optical photometric monitoring as well as by simultaneous photometric observations in a spectral range from 0.4 to $\sim 10\ \mu$m.

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NEW PHOTOELECTRIC PHOTOMETRY OF THE NEGLECTED CONTACT BINARY EP And

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Contact binary EP And (GSC 2827-17, $1^{\rm h}42^{\rm m}29\overset{\rm s}{.}32$, $+44°45'42''\!.4$, 2000.0, $V_{\rm max} = 11\overset{\rm m}{.}9$) was discovered by Strohmeier et al. (1955). Due to high proper motion, the system was later misidentified and designated as NSV 598 (see Mánek, 1994). Its orbital period was recently studied by Qian & Yuan (2001). The authors concluded that the period of the system is increasing at the rate $dP/dt = 1.16 \times 10^{-7}$ day year^{-1} and gave the following quadratic ephemeris for the primary minimum:

$$\begin{array}{l} \text{Min I} = 2\,442\,638.5134 + 0.404110940 \times E + 6.44 \times 10^{-11} \times E^2. \\ \qquad\qquad\qquad \pm 9 \qquad\qquad\qquad \pm 1 \qquad\qquad\qquad \pm 9 \end{array} \tag{1}$$

Apart from two photoelectric (Hoffmann, 1983) and one CCD (Diethelm, 1997) minima no photoelectric or CCD light curve of the system has been published. Therefore we included the system into the photoelectric monitoring of contact binaries.

New BV light curves of EP And were obtained at the Stará Lesná observatory of the Astronomical Institute of the Slovak Academy of Sciences. The observations were taken on for nights August 15, 16 and September 19, 20, 2001. The 0.6-m Cassegrain telescope equipped with a single-channel photoelectric photometer was used. Data reduction, the atmospheric extinction correction and transformation to the standard international BV system were carried out in the usual way (see Pribulla et al., 2001). GSC 2827-575 and GSC 2827-2135 were used as the comparison and check stars, respectively. The comparison star was found to be stable with respect to the check star within $0\overset{\rm m}{.}015$ in the V passband. Our observations were used to determine 3 new minima times (Table 1) using Kwee & van Woerden method. All BV observations, shown in Fig. 1 (with respect to GSC 2827-575), were phased using linear ephemeris:

$$\begin{array}{l} \text{Min (I)} = \text{HJD } 2\,452\,137.5293 + 0.40411056 \times E, \\ \qquad\qquad\qquad\qquad\quad \pm 20 \qquad\qquad\quad \pm 19 \end{array} \tag{2}$$

determined from all available photoelectric ($w = 2$) and CCD minima ($w = 1$). The minima occur at present about 0.125 of the period later than predicted by ephemeris (1).

The shape of the minima (Fig. 1) indicates that the system is very probably totally eclipsing. Therefore we tried to found preliminary photometric elements. Since the binary is rather faint its spectral type is unknown. The Tycho Catalogue (ESA, 1997) gives

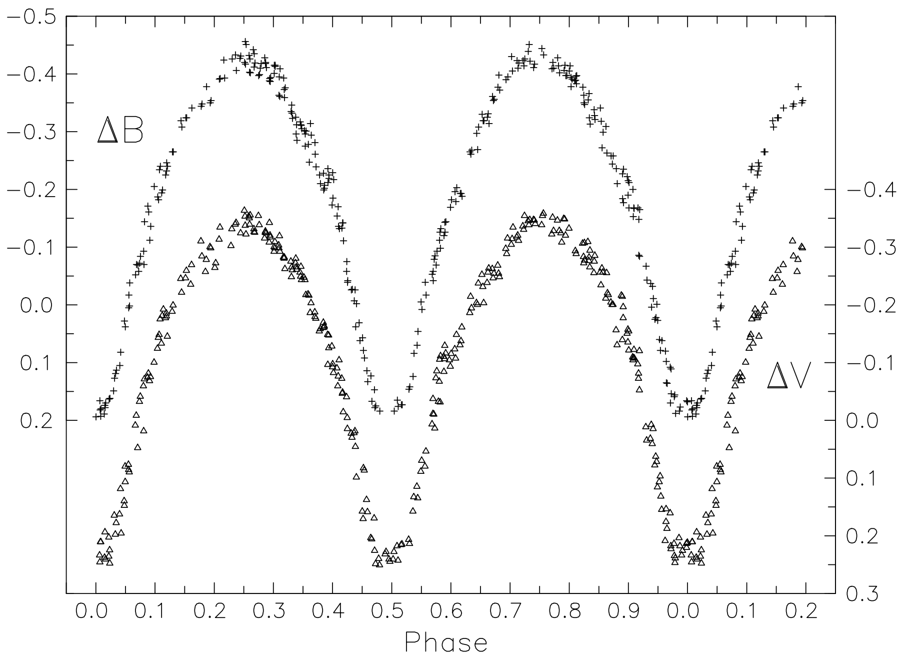

Figure 1. *BV* light curves of EP And with respect to GSC 2828-575 according to ephemeris (2)

$B-V = 0.626 \pm 209$. Due to the large error (caused by the variability of the system) and interstellar absorption we have estimated the intrinsic colour index from the period-colour relation of Wang (1994): $(B-V)_0 = 0.062 - 1.31 \log P$. The resulting intrinsic colour $(B-V)_0 = 0.577$ corresponds to the F9V spectral type and $T_{\rm eff} = 5960$ K (Popper, 1980). The depth of the minima $\approx 0\overset{m}{.}60$ limits the possible range of the mass ratios to $m_2/m_1 > 0.3$. For $q > 0.35$ because of the observed depth of the minima, the eclipses would be partial. The photometric elements were determined using the 1992 version of the Wilson & Devinney (1971) code. The limb and gravity darkening coefficients as well as bolometric albedos were fixed appropriate to the convective envelope and mean effective temperature. The resulting photometric elements are: $q = 0.34$, $i = 80\overset{\circ}{.}4$, fill-out $= 0.39$, $T_2 = 6073$ K. The corresponding fits are depicted in Fig. 2. Although the secondary component is slightly hotter and the system is probably of W UMa type, the minima are of the same depth (due to the limb darkening). The secondary minimum (corresponding

Table 1: New times of primary (I) and secondary (II) minima obtained at the Stará Lesná observatory. The standard errors of the minima are given in parentheses. The $O-C$ residuals are given with respect to ephemeris (1)

$\mathrm{JD_{hel}}$ 2 400 000+	Filter	Type	$O-C$
52137.5286(1)	B	I	−0.0521
52137.5292(1)	V	I	−0.0515
52138.5379(4)	V	II	−0.0531
52138.5380(1)	B	II	−0.0530
52173.4966(3)	V	I	−0.0503
52173.4969(2)	B	I	−0.0500

to accepted ephemeris for this system) is the transit.

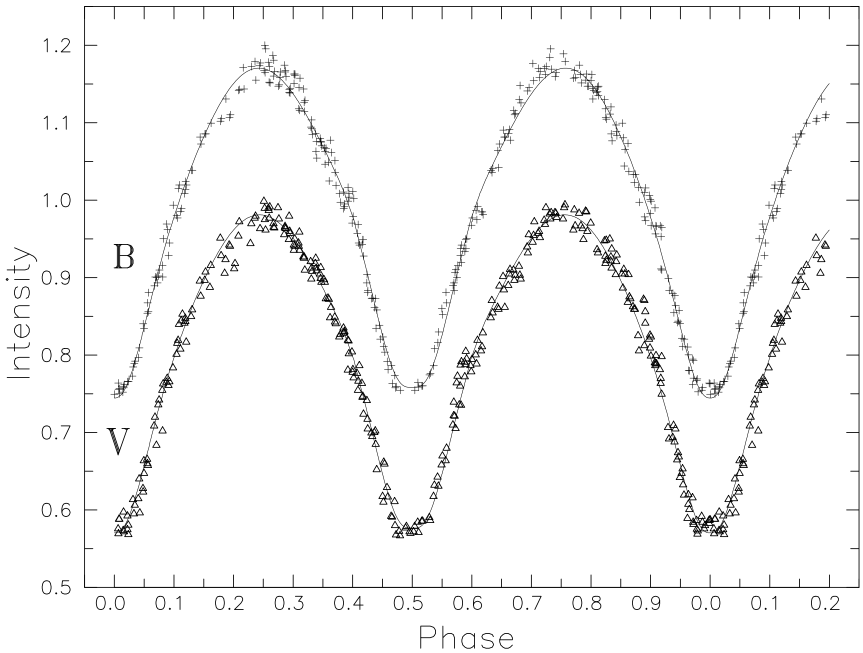

Figure 2. The best fits of BV observations for $q = 0.34$. The B passband observations are shifted by 0.2 in intensities for clarity

The conclusive determination of the photometric elements, reliable classification of the light curve and type of the eclipses would require more numerous and precise observations.

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COORDINATES AND IDENTIFICATIONS FOR DOLIDZE S, C, AND MS STARS

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In the course of other work I have obtained complete identifications for a problematic list of late-type stars by Dolidze (1975a). The charts were used to make the identifications. Since numerous substantial errors were found that have propagated elsewhere in the literature, it was thought useful to publish the list separately. The corrections allow linkage of the stars to other catalogues in the visible and infrared. This complements a second similar list of late-M stars by Dolidze (Dolidze 1975b, Skiff 1997).

Table 1 lists the ninety-one stars along with the best available positions and principal identifications. The acronym '[D75b] Star' has been assigned to the stars in the Lortet *et al.* (1994) "Dictionary". An asterisk next to the name indicates a note following the table. The coordinates were drawn, in descending order of preference, from: UCAC1 (Zacharias *et al.* 2000), Tycho-2 (Høg *et al.* 2000), the 2MASS point-source catalogue (second release, Skrutskie *et al.* 2000), GSC-ACT (Gray 1999), USNO-A2.0 (Monet *et al.* 1998), or the recent GSC-2.2 (STScI 2001). The source of the positions is coded in column 's' as follows: A = USNO-A2.0, G = GSC-ACT, g = GSC-2.2, M = 2MASS, T = Tycho-2, U = UCAC1.

GSC and IRAS names are given as available. The MSX catalogue (Price *et al.* 2001) was a useful aid in identifying some of the stars. MSX identifications are shown in the notes for objects not appearing in the IRAS catalogue. Since no indication of brightness is given for the stars by Dolidze (or in SIMBAD), rough photo-blue magnitudes largely from USNO-A2.0 are listed for nearly all the stars. The spectral types are from Dolidze. As indicated in the notes, not all of these are correct, but are given as a record of the source paper. The last column shows mostly variable-star designations or names from the Stephenson S-star (1984, CSS) and carbon-star (1989, CGCS) or "reddened" star (Stephenson 1992, StRS) catalogues. Two-thirds of the stars have additional identifications and comments in the notes.

Table 1: Positions and identifications

[D75b]	RA (2000)	Dec	s	GSC	IRAS	mb	spec	Other IDs
1*	0 07 42.6	+60 22 54	-	4014-0240		15.1	S	CSS 4
2	0 46 53.27	+56 40 08.4	G	3663-1363	00439+5623		C	GW Cas
3	1 00 53.16	+56 36 45.2	T	3676-1346	00578+5620	10.9	S7,2	V365 Cas
4	1 28 36.19	+61 12 07.7	G	4031-2015	01252+6056		S	PQ Cas
5	1 29 44.00	+61 41 41.7	G	4031-1549	01263+6125	15.2	S	CSS 37
6*	1 35 09.71	+60 17 09.9	G	4031-2130	01318+6001	15.5	S	CSS 38
7*	1 54 19.71	+21 53 20.6	T	1212-0468	01515+2138	10.6	S7,3	NSV 15403

Table 1 (cont'd.): Positions and identifications

[D75b]	RA (2000)	Dec	s	GSC	IRAS	mb	spec	Other IDs
8	2 08 31.02	+62 22 44.5	G	4037-2533	02048+6208	14.4	S	CSS 47
9	2 18 52.44	+62 48 13.5	G	4050-0812	02151+6234	18.2	S	CSS 50
10	2 19 16.76	+59 42 21.5	G	3698-2179	02156+5928	15.1	MS	CSS 53
11*	2 21 20.28	+61 23 54.0	A		02176+6110	19.1	CS:	CSS2 9
12*	2 23 11.95	+63 51 58.1	G	4054-0897		17.1	S	StRS 44
13	2 24 44.77	+55 35 45.8	A			15.0	MS	
14*	2 25 19.32	+58 16 10.4	G	3698-2696		16.0	MS	
15	2 32 45.05	+58 14 37.5	G	3699-1448	02290+5801		C	DU Per
16*	2 38 33.45	+61 54 31.1	G	4051-2337		15.6	MS	CSS 59
17	2 40 29.35	+62 16 20.3	G	4051-2343	02365+6203	15	C	CGCS 388
18*	2 44 31.02	+60 18 49.6	G	4047-2083		16.8	C	
19	2 46 23.19	+60 08 20.0	G	4047-0252	02424+5955	16.3	S	CSS 64
20	2 51 36.05	+59 07 11.7	A		02478+5854	17.2	S	CSS 66
21*	2 53 44.55	+58 57 44.1	G	3713-1162	02498+5845	15.7	S	
22*	2 58 14.89	+61 43 07.2	A			16.2	S	CSS 68
23*	3 16 40.87	+58 23 53.4	G	3714-0995	03127+5812	15.3	C:	CGCS 467
24*	3 17 36.46	+59 41 52.3	A		03136+5930	17.7	S	CGCS 469
25*	3 39 50.79	+51 06 30.6	T	3325-0367	03361+5056	13.3	S	CSS 78
26*	4 28 18.53	+25 31 41.1	G	1833-0749	04252+2525	14.5	C(R)	V414 Tau
27*	4 56 07.33	+48 03 05.8	G	3348-2323		15.5	C:S:	
28*	4 59 15.25	+47 36 01.2	G	3348-0978	04554+4731	15.9	MS	
29*	5 06 30.15	+34 37 41.0	G	2397-0721		15.1	S	DK Aur
30*	5 11 33.59	+47 40 47.0	G	3349-0826		15.1	MS	CSS 122
31	5 11 39.28	+29 06 21.4	G	1858-0893	05085+2902	16.1	S	CSS 125
32*	5 25 29.98	+32 53 08.3	M	2407-0897		14.6	MS	CSS 136
33*	5 28 37.35	+34 02 28.1	M	2411-2106		15.2	MS	CSS 140
34*	5 29 33.67	+27 49 34.2	M	1856-0659		14.3	MS	
35	5 32 44.19	+29 02 51.7	M	1860-0128	05295+2900	16.8	MS	CSS 143
36	5 35 11.21	+37 45 46.0	M	2910-0836	05318+3743	17.1	MS	
37	5 36 52.06	+29 02 15.4	M		05336+2900	17.8	S	CSS 146
38*	5 38 17.62	+28 11 44.1	M	1873-0803	05350+2809	14.7	S	CSS 148
39	5 38 22.19	+35 37 29.2	G	2412-0264	05350+3535	16.1	S	CSS 147
40*	5 39 15.52	+20 28 55.3	M			14.9	S:C:	
41*	5 53 10.07	+29 13 27.9	M	1875-0733		14.9	S	CSS 169
42	6 02 37.80	+29 07 05.8	M	1876-1740		15.1	MS	CSS 180
43	6 05 27.89	+22 20 42.1	M		06024+2220	15.7	MS	CSS 185
44	6 08 26.23	+28 06 43.1	M	1885-1055	06052+2807	13.9	S	CSS 188
45	6 08 44.67	+31 09 41.1	M	2419-1008	06054+3110	15.0	S	CSS 189
46*	6 09 32.97	+31 31 46.6	M		06062+3132	14.9	MS	CSS 190
47*	6 10 09.60	+23 33 00.9	M			14.7	MS:	CSS 193
48	6 10 34.60	+23 38 54.4	M	1877-1613	06075+2339	13.9	MS:	CSS 195
49*	6 18 52.52	+21 12 16.1	M	1327-1382		15.2	MS:	CSS 208
50	6 23 52.89	+21 18 30.1	T	1327-1623	06208+2120	13.4	S	CSS 214
51	6 36 27.03	+07 00 33.3	G	0158-0371	06337+0703	14.9	S	CSS 232
52*	6 39 03.23	+02 34 00.2	A			15.2	MS	CSS 240
53	6 43 56.34	+01 44 59.3	A		06413+0148	14.9	S	CSS 249
54*	6 44 42.71	+07 03 58.2	G	0159-3098		15	S	CSS 250
55*	6 44 29.74	−02 32 32.0	M	4803-1048	06419−0229	14.2	S	NSV 3190
56	6 45 32.39	+06 47 06.4	G	0160-2107		15.1	S	CSS 255
57	6 47 36.24	+09 38 19.6	G	075102499	06448+0941	15.3	MS	BF Mon
58	6 48 08.67	+06 29 24.1	A		06454+0632	15.6	S	CSS 259
59	6 48 57.08	+06 56 33.2	G	0160-0959	06462+0659	14.0	S	CSS 262
60	6 55 40.14	−05 31 02.4	G	4809-0418	06532−0527	14.4	S	EN Mon
61*	7 14 01.66	−14 36 00.7	T	5406-0728	07117−1430	12.8	C5,2	NSV 3471
62*	7 23 08.35	−14 16 15.0	G	5407-2172	07208−1410	16.0	C3,3	CGCS 1684

Table 1 (cont'd.): Positions and identifications

[D75b]	RA (2000)	Dec	s	GSC	IRAS	mb	spec	Other IDs
63*	16 08 54.56	−21 56 18.9	U	6213-1036		14.7	C:S:	
64	18 22 42.51	−16 29 28.2	U		18198−1631	16.8	S:C:	CSS 1035
65*	18 23 34.97	−17 05 10.2	U	6269-0443		12.8	S	CSS 1036
66	18 33 02.93	−19 46 26.1	G	6275-0751	18300−1948	13.3	S	V2003 Sgr
67	18 30 34.57	+36 14 57.0	T	2636-0435	18288+3612	9.3	M7Se	V530 Lyr
68*	20 06 33.96	+24 26 00.0	T	2158-0309	20044+2417	13.7	S4,2	DK Vul
69*	20 09 10.39	+21 57 03.1	T	1630-2890	20069+2148	12.4	C2,5	NSV 12842
70	20 12 32.28	+46 51 13.7	G	3559-2601	20109+4642	15.3	S	CSS 1197
71	20 13 08.46	+48 34 45.0	T	3563-0623	20116+4825	14.1	C	V1955 Cyg
72*	20 27 08.12	+36 33 06.5	T	2697-0092	20252+3623	13.2	S	V441 Cyg
73*	20 28 06.44	+42 55 07.2	M		20263+4245	18	C	CGCS 4868
74	20 41 28.71	+36 35 02.5	M		20395+3624	16.8	C	CGCS 4936
75*	20 45 55.29	+36 32 18.6	M	2699-2004		15	S	CSS 1238
76*	20 47 43.36	+34 19 03.3	M	2695-3678	20457+3408	15.8	S	V1976 Cyg
77*	20 49 46.16	+11 29 41.7	T	1098-1282	20473+1118	8.4	K2p	HD 198403
78*	20 50 41.32	+39 49 41.3	A			17.4	S	NSV 25365
79*	21 01 19.71	+36 25 53.8	M			14.4	S	V1896 Cyg
80*	21 14 19.81	+38 00 58.5	M			18.8	SC:	V1235 Cyg
81*	21 37 19.03	+47 59 59.1	M			17.0	S	CSS 1280
82*	21 44 29.21	+50 57 16.8	A			16.2	S	CSS 1282
83*	21 55 24.87	+63 53 21.4	G	4270-0794	21540+6339	14.8	C	CGCS 5508
84*	22 04 06.10	+59 52 45.2	G	3981-1326		16.5	S	CSS 1289
85*	22 08 33.64	+63 34 54.0	G	4267-2710		15.2	C	V513 Cep
86	22 09 47.53	+61 09 36.2	G	4263-1284	22081+6054	14.8	MS	
87	22 23 54.88	+57 00 16.5	A		22220+5645	16.3	S	CSS 1297
88*	23 14 52.69	+49 37 40.9	T	3631-1405	23125+4921	12.8	S4,3	BD+48°3979
89*	23 37 39.74	+58 50 45.9	g		23352+5834		S	V850 Cas
90	23 46 18.48	+66 49 27.6	G	4293-0030	23439+6632	16.5	MS	
91*	23 57 21.31	+58 25 03.7	A		23548+5808	16.6	S:C:	V653 Cas

Notes:

1 the proper-motion star G 217-32; position is for epoch 2000; probably not S type
6 Dolidze position grossly in error
7 BD +21°255 = DO 8975 (K5)
11 middle star in a 20″ arc of three
12 CSS 55 = MSX5C G132.8280+02.7717
14 MSX5C G135.0340−02.3791
16 MSX5C G135.1851+01.6128
18 [ABC90] maa 28 = MSX5C G136.4983+00.4551
21 S1* 52; M star, not S; see CSS rejected stars
22 MSX5C G137.3620+02.4544; previously erroneously identified as IRAS 02545+6133 (wrong Dolidze position, IRAS fluxes are for a nebula)
23 DO 26880 (N) = MSX5C G141.0116+00.7197
24 S1* 55 = CSS 71
25 DO 27408 (M2)
26 CGCS 696
27 ID assumes Dolidze chart has wrong star marked
28 Dolidze position switched with star 30, *cf.*
29 NIKC 5-7 = MSX5C G170.6337−03.7048
30 Dolidze position switched with star 28, *cf.*; in open cluster NGC 1798
32 MSX5C G174.3450−01.4985
33 MSX5C G173.7492−00.3139
34 MSX5C G179.0448−03.5796
38 MSX5C G179.7805−01.7574, IRAS position poor
40 not confirmed as S type by Stephenson (1984), but 2MASS $J-K=1.6$
41 MSX5C G180.6024+01.5613
46 previously erroneously identified as HD 252257 (F5) = BD +31°1209, for which Tycho-2 $B-V=0.54$

47 MSX5C G187.4163+02.0648
49 MSX5C G190.4408+02.7191
52 MSX5C G209.2346−01.5810
54 MSX5C G205.8757+01.7297
55 CSS 251
56 also CSS 253: CSS has $-30'$ Dec typo; MSX5C G206.2205+01.7840
61 CGCS 1610 = CSS 323; Dolidze $-1^{\mathrm{m}}/+10'$ position error. CGCS 1610 previously erroneously identified as GSC 5406-1554, for which Tycho-2 $B-V=0.43$
62 same as CGCS 1687
63 late-M type according to Stephenson CGCS reject list
65 MSX5C G014.6028−01.7665
68 DO 18567 (M6)
69 CGCS 4693
72 DO 19014 (M5); S4,6 (Stephenson 1984)
73 Kiso C3-26
75 MSX5C G077.9334−04.0741; previously erroneously identified as IRAS 20438+3622, which is another red star in the field
76 CSS 1240
77 Dolidze notes that CH and BaII are possibly present in the spectrum
78 MSX5C G081.0885−02.7369
79 CSS 1256
80 ID assumes Dolidze chart has wrong star marked
81 MSX5C G092.7896−03.1822
82 MSX5C G095.6156−01.7247
83 this star is *not* IRAS 21540+6341 = V500 Cep, which is a much fainter star $3'$ north in the open cluster Berkeley 93 (and probably an M-supergiant, not a carbon star)
84 MSX5C G103.3386+03.5334
85 CGCS 5591; the carbon star was previously erroneously identified as GSC 4267-1485, which is a blue star (Tycho-2 $B-V=0.23$)
88 CSS 1326 = DO 42750 (M4); Dolidze -1^{h} RA error
89 type M5/7 in Dolidze (1975b)
91 CSS 1344

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GSC 1172.1452 (BRH V30) IS A NEW ECLIPSING BINARY OF W UMa TYPE

(BAV MITTEILUNGEN NO. 139)

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Name of the object:
GSC 1172.1452

Equatorial coordinates:	**Equinox:**
R.A.= $23^h32^m32\overset{s}{.}6$ **DEC.=** $10°33'20''$	2000

Observatory and telescope:
W. Moschner: Private observatory, 32-cm Ritchey–Chrétien telescope;
K. Bernhard: Private observatory, 20-cm Schmidt–Cassegrain telescope

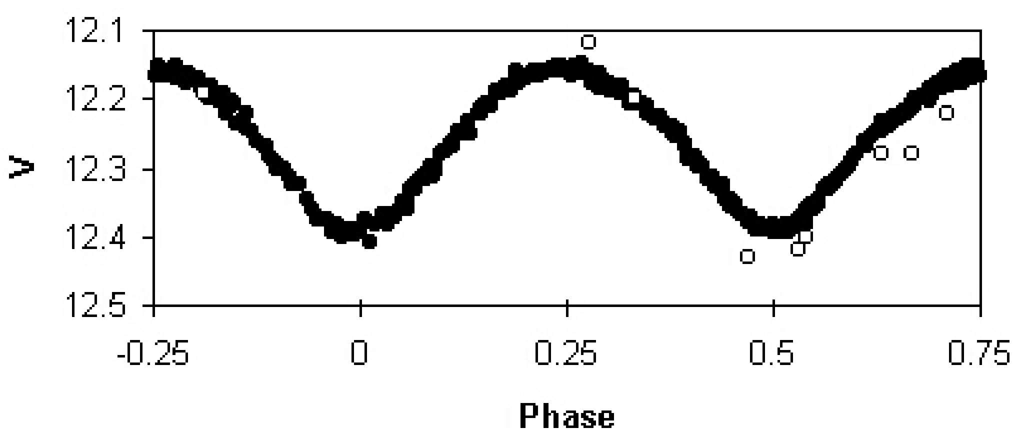

Figure 1. The phase diagram of GSC 1172.1452 assuming that the comparison star GSC 1172.1385 has $V = 11.7$. The CCD observations of Bernhard (open circles) and W. Moschner (filled circles) are folded with the ephemeris given in the text

Detector:	W. Moschner: SBIG ST-9 camera; K. Bernhard: Starlight Xpress SX camera

Filter(s):	W. Moschner, K. Bernhard: None

Comparison star(s):	GSC 1172.1385, $V \approx 11\overset{m}{.}7$

Check star(s):	GSC 1172.1483

Transformed to a standard system:	No

Availability of the data:

Upon request

Type of variability:	W UMa

Remarks:

In 1999 the variability of GSC 1172.1452 has been found as part of a programme to discover and classify new variables using CCD observations of selected fields on the edge of the northern Milky Way (eg. Bernhard & Lloyd 2000). Additional observations were performed on 9 nights between November 1999 and September 2001 (W. Moschner). This star has previously been referred to as Brh V30 (Bernhard 1999, Moschner 2001).
The times of minima were calculated using Kwee and Van Woerden method:

Type	JD Hel.	Error
Min I	2451487.3384	0.0010
Min II	2452123.4786	0.0005
Min I	2452133.5752	0.0005
Min II	2452135.4594	0.0005
Min II	2452136.4862	0.0005
Min II	2452137.5136	0.0005
Min I	2452144.5286	0.0005
Min I	2452176.3612	0.0005

The ephemeris was calculated using the "Least Square Method" on the observed times of MinI:

$$\begin{array}{ll} \mathrm{MinI} = \mathrm{HJD}\ 2452144.5285 + 0\overset{d}{.}3422865 \times E. \\ \qquad\qquad\qquad\qquad\ \pm 15 \qquad\qquad \pm 10 \end{array} \tag{1}$$

Acknowledgements:

This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France.

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COORDINATES AND IDENTIFICATIONS FOR ROSINO'S RED VARIABLES NEAR NGC 6749

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As part of a photometric study of the obscured globular cluster NGC 6749, Rosino *et al.* (1997) include a list of seventy-eight new red variables within 1° of the cluster. Although two of the stars lie near the cluster, probably none of them is related to it. Perhaps because the stars' positions were given to only $0\overset{\prime}{.}1$ precision, none of the stars has yet received a GCVS designation.

The table below provides accurate coordinates and identifications for all the stars, which were discovered by Leonida Rosino. Their locations were verified on charts of the region prepared by Rosino, copies of which were provided by Sergio Ortolani. In general the original coordinates are reasonably accurate, so that identification could be made through direct comparison with the IRAS and MSX infrared catalogues, and in visible light via USNO-A2.0 and GSC-2.2. Not all the stars appear in these catalogues, and there are some modest position errors, so the charts were indispensable. In addition, many fields were examined on the sky-survey plate-scans from the USNO-Flagstaff "pixel server" (Levine 2001). The POSS-II far-red IV-N plate-scans available here made locating these very red stars a simple task; the multi-epoch red and blue plates also allowed verification of variability in many cases.

Table 1 lists the stars in the same order and with the same designations given by Rosino *et al.* (1997) in their Table 3 (only the first name if two are shown). Following common convention, I suggest the acronym '[ROB97]' be used for these stars since they are not related to the globular cluster. An asterisk by the name indicates a note following the table. Many of the stars are very faint in blue light, and are thus not recorded in USNO-A2.0 (Monet *et al.* 1998): because objects were required to be detected on both plates in order to be accepted for the catalogue. Recourse was then made to GSC-2.2 (STScI 2001) since this can include stars appearing only on the POSS-II IIIa-F red-light plates. Some stars were in neither of these, but a reliable if not precise position was found in the MSX catalogue (Price *et al.* 2001), where the accuracy is $\pm 3''$–$5''$. Positions for a few stars were estimated ($\pm 2''$) using DSS images from the Goddard SkyView utility. Two stars are best recorded in the GSC-ACT (Gray 1999). The position sources are coded in column 's' of the table as follows: A = USNO-A2.0, G = GSC-ACT, g = GSC-2.2, S = SkyView, X = MSX.

Table 1: Red variables near NGC 6749

[ROB97]		RA (2000)	Dec	s	IRAS	MSX5C	*mb*	*mr*
95		19 03 36.59	+02 37 37.0	g		G036.6581–01.5062		16.5
39		19 03 40.5	+01 42 36	X	19011+0138	G035.8502–01.9408		
63		19 04 08.04	+02 41 54.4	A	19016+0237	G036.7815–01.5906	19.2	13.8
2	*	19 04 08.40	+01 58 56.1	g	19016+0154	G036.1456–01.9191		16.9
40		19 04 18.26	+01 30 41.2	g		G035.7456–02.1714		18.0
44		19 04 18.28	+02 51 12.5	g	19017+0246	G036.9392–01.5571	18.2	15.0
3		19 04 34.19	+02 06 45.9	g		G036.3107–01.9553		15.3
151b	*	19 04 39.55	+01 22 18.0	g	19021+0117	G035.6617–02.3146	18.3	13.3
17	*	19 04 42.82	+02 51 42.5	g	19022+0247	G036.9932–01.6440	19.4	17.9
19		19 04 50.52	+02 22 30.2	g	19023+0217	G036.5753–01.8953		17.7
92		19 04 51.16	+01 31 42.4	g	19023+0127	G035.8236–02.2853		15.7
17b	*	19 04 51.7	+02 54 18	X	19023+0249	G037.0486–01.6572		
5		19 04 50.78	+02 33 20.3	A	19023+0228	G036.7366–01.8133	19.4	15.6
7	*	19 04 53.17	+02 08 40.3	g	19023+0204	G036.3748–02.0111	17.0	13.5
36A		19 04 55.82	+01 21 29.5	g	19023+0116	G035.6806–02.3809		16.3
4		19 04 54.01	+02 37 47.3	g	19024+0233	G036.8080–01.7920	19.5	16.7
37		19 05 04.61	+01 16 03.9	A	19025+0111	G035.6168–02.4547	19.5	16.4
41		19 05 10.31	+01 38 02.3	A			19.6	16.7
26		19 05 09.85	+02 18 00.1	g	19026+0213	G036.5457–02.0015		15.4
6-12	*	19 05 09.7	+02 13 38	X	19026+0209	G036.4804–02.0344		
91		19 05 14.64	+01 44 52.2	A		G036.0633–02.2721	19.3	14.1
A-1	*	19 05 14.69	+01 55 51.6	A	19027+0151	G036.2267–02.1886	19.0	17.5
A-2		19 05 17.34	+01 53 31.5	g	19027+0148	G036.1965–02.2166		16.8
42		19 05 18.49	+01 39 35.9	g	19027+0134	G035.9926–02.3266	18.7	16.2
27		19 05 19.88	+02 27 41.2	g	19028+0223	G036.7083–01.9648	19.2	17.4
10		19 05 21.84	+01 42 33.0	A		G036.0428–02.3158	19.0	16.6
31b		19 05 56.40	+02 56 51.2	g	19034+0252	G037.2099–01.8761	19.4	14.5
8		19 06 01.62	+02 08 58.3	A		G036.5099–02.2616	16.5	15.5
4-3		19 06 01.48	+01 50 03.3	g	19035+0145	G036.2290–02.4058		16.5
60		19 06 07.61	+01 22 01.9	g	19035+0117	G035.8257–02.6421		15.2
9		19 06 17.11	+02 12 42.0	g	19037+0207	G036.5952–02.2906	18.6	
12	*	19 06 19.23	+01 57 02.0	g	19038+0152	G036.3667–02.4182		17.3
37h		19 06 27.9	+00 59 42	X	19039+0055	G035.5331–02.8881		
6-6		19 06 28.3	+03 10 19	X		G037.4705–01.8922		
31ter	*	19 06 39.45	+03 26 26.6	G	19041+0321	G037.7290–01.8106	15.5	
20	*	19 06 41.25	+03 02 18.1	G		G037.3769–02.0004		
6-4	*	19 06 43.08	+03 17 12.4	A			18.0	15.0
6-4b	*	19 06 45.2	+03 16 41	S		G037.5965–01.9073		
31	*	19 06 46.86	+03 25 21.7	g		G037.7275–01.8459		12.9
20c	*	19 06 58.20	+02 59 09.2	g				17.4
20b	*	19 06 55.76	+02 59 44.4	A	19044+0254	G037.3662–02.0744	18.1	13.8
51		19 07 01.16	+01 29 59.1	g	19044+0125	G036.0464–02.7801		14.8
81	*	19 07 03.16	+02 31 02.0	g		G036.9552–02.3214		18.2
80		19 07 13.23	+01 17 20.3	A	19046+0112	G035.8811–02.9211	16.3	12.3
30		19 07 12.9	+03 21 03	X	19047+0316	G037.7147–01.9748		
6-2	*	19 07 14.15	+03 25 05.8	g		G037.7769–01.9494		18.1
53b	*	19 07 19.30	+01 49 34.3	g	19047+0144	G036.3710–02.6974	18.3	16.2
X-2	*	19 07 27.08	+02 24 33.8	A		G036.9046–02.4591	19.9	15.3
X-1	*	19 07 31.27	+02 33 42.9	g	19049+0228	G037.0480–02.4031	17.4	14.8
19-II		19 07 34.10	+02 50 10.2	A		G037.2980–02.2891	18.3	16.1

Table 1 (cont'd.): Red variables near NGC 6749

[ROB97]		RA (2000)	Dec	s	IRAS	MSX5C	*mb*	*mr*
32		19 07 37.6	+03 29 25	X	19051+0324	G037.8860–02.0022		
82	*	19 08 06.96	+02 19 09.1	g		G036.9008–02.6471		15.9
82b	*	19 08 06.30	+02 17 41.6	g		G036.8784–02.6570	18.4	15.5
18	*	19 08 10.00	+02 31 50.2	A			17.7	14.2
53		19 08 18.3	+01 46 28	X	19057+0141	G036.4378–02.9400		
52b		19 08 33.68	+01 55 52.9	A	19060+0150	G036.6067–02.9246	19.3	14.9
25d	*	19 08 45.78	+03 16 01.9	A	19062+0311	G037.8176–02.3571	15.8	11.8
52	*	19 08 48.10	+01 39 28.8	A	19062+0134	G036.3932–03.1054	18.1	14.9
83	*	19 08 49.8	+02 50 46	X	19063+0245	G037.4513–02.5647		
25		19 09 02.79	+03 06 25.0	g		G037.7085–02.4934	17.2	13.8
33	*	19 09 17.34	+02 54 52.5	A	19067+0249	G037.5654–02.6349	18.8	15.4
25b	*	19 09 31.32	+03 03 16.4	g	19069+0258	G037.7171–02.6229	17.5	13.3
22		19 09 40.86	+02 13 25.7	g	19071+0208	G036.9955–03.0391	19.2	13.7
6-14	*	19 09 52.96	+02 54 21.0	A	19073+0249	G037.6255–02.7710	17.5	14.0
45	*	19 09 53.63	+02 46 27.1	A	19074+0241	G037.5101–02.8336	17.7	12.8
6-14b		19 09 58.89	+02 51 33.5	A	19074+0246	G037.5958–02.8137	18.2	14.6
0-2	*	19 10 02.66	+03 03 50.5	g		G037.7852–02.7342	19.3	16.1
7-1		19 10 06.6	+03 43 26	X	19076+0338	G038.3787–02.4449		
23		19 10 08.55	+02 16 29.8	g	19076+0211	G037.0943–03.1183		15.4
25e	*	19 10 06.99	+03 08 17.4	g	19075+0303	G037.8584–02.7161		
34		19 10 12.30	+02 44 37.5	A		G037.5181–02.9159	17.6	14.2
44c	*	19 10 21.83	+02 24 20.4	g			19.1	17.8
44b		19 10 23.52	+02 25 25.4	g		G037.2556–03.1049	19.4	17.6
6-14a		19 10 21.70	+02 58 07.6	g		G037.7368–02.8484	18.9	17.0
24		19 10 25.59	+02 18 32.5	g		G037.1574–03.1649	18.1	14.0
6C	*	19 11 10.88	+02 35 02.1	g		G037.4885–03.2073	19.2	15.9
6-16		19 11 30.0	+02 50 25	S				
6d		19 12 00.88	+02 34 27.9	g	19094+0229	G037.5758–03.3944	16.8	

Notes:

2	ROB $+2^s$ RA error
151b	PK 035–02 1 (not a planetary nebula)
17	ROB $-0\overset{'}{.}7$ Dec error
17b	crowded; northwestern star in a $\sim 5''$ trio
7	southeastern star of a $\sim 2''$ pair; companion is not red
6-12	northern star of a $\sim 2''$ pair; companion is not red
A-1	Cl* NGC 6749 ROB A-1; crowded
A-2	superposed on NGC 6749; crowded
12	ROB $-2^s/+0\overset{'}{.}9$ position error
31ter	GSC 0466-0506; ROB $+0\overset{'}{.}7$ Dec error; crowded
20	GSC 0466-2783; crowded
6-4	ROB $+1^s/-1\overset{'}{.}2$ position error
6-4b	ROB $-15''$ Dec error
31	crowded
20c	ROB $-2^s/-1\overset{'}{.}1$ position error
20b	ROB $+2^s/-0\overset{'}{.}6$ position error; chart ID unambiguous
81	ROB $25''$ position error (wrong star marked on chart)
6-2	ROB $-20''$ Dec error
53b	ROB $-15''$ Dec error

X-2	ROB -1^s RA error
X-1	ROB 35″ position error; crowded by star on southwest
82	ROB 15″ position error
82b	ROB 14″ position error
18	ROB -2^s RA error; not in IRAS/MSX, but chart ID unambiguous. southwestern star of a $\sim 2''$ pair
25d	ROB 27″ position error, but ID certain from mags, type M8 in Kwok *et al.* (1997)
52	crowded
83	eastern star of a $\sim 4''$ pair
33	outside IRAS position error-ellipse, but ID near-certain
25b	large IRAS position error-ellipse
6-14	ROB 18″ position error
45	IRAS position poor
0-2	southeastern star of a $\sim 2''$ pair
25e	ROB $+2^s$ RA error, southwestern star of a pair
44c	ID unambiguous on POSS-II IV-N scans
6C	ROB 19″ position error

The two columns following the coordinates show IRAS and MSX names as available. Both surveys reach to relatively faint limits in this area, evidently due to favorable infrared backgrounds. Photo-blue (mb) and -red (mr) magnitudes from either USNO-A2.0 or GSC-2.2 are shown as a rough guide in brightness. Periods and magnitude ranges in the I band are given in the source paper. At maximum the stars lie in the range $10^{\rm m} < I < 13^{\rm m}$. Rosino *et al.* (1997) note that the spectral classes of the stars are between M5 and M8, but types are not available for individual stars.

I am grateful to Sergio Ortolani (Univ. Padova) for supplying photocopies of Rosino's charts of the field, and for friendly help and interest. I also received helpful correspondence from Nikolai Samus (Sternberg Institute).

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FURTHER IMPROVEMENT OF THE PERIOD AND NEW R LIGHT CURVE OF CQ UMa

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The cool chemically peculiar SrCrEu star CQ UMa = HR 5153 = HD 119213 (m_V = 6.28) belongs to the best photometrically monitored stars of its type. The star exhibits relatively large light variations in the blue (namely in Strömgren's v colour) and smaller antiphased ones in the red. While in the blue and yellow regions hundreds of reliable photometric measurements exist, our knowledge about the light behaviour of the star in the red and near infrared only reposed on several measurements done by Musielok et al. (1980) as a part of their intermediate band ten-colour photometry.

The requirement of reliable red data and need for enlargement of the time base of light variation measurements essential for further improvement of the period of the star induced us to start with systematic observations of CQ UMa in Strömgren's v filter and Johnson's R filter.

The detailed history of the CQ UMa period determination is published in Mikulášek (1987). The latest improvement of light elements based on 215 B and 102 v measurements referred to the more or less symmetrical minimum of light in v colour were published by Žižňovský & Mikulášek (1995):

$$\mathrm{JD_{hel}}(\mathrm{Min}\ v) = 2445349.7263(47) + (E - 1878) \times 2\overset{\mathrm{d}}{.}4499141(38).$$

In this paper we present 54 measurements in R and 30 new measurements in v taken in 56 individual moments in the time interval from March 1994 to May 2000. All photometric measurements were done by the red sensitive photometer attached to the 0.6-m telescope of the Skalnaté Pleso Observatory. HD 120874 = HR 5216 (m_V = 6.46) was used as a comparison star. All new data obtained were used for the improvement of the period of CQ UMa.

The comprehensive examination of all currently available photometric data (including our new data — see Figs. 1 and 2) particularly confirmed that each of the observed light curves in the region at least 350 nm to 800 nm can be well enough represented by the linear combination of a constant and two basic harmonic polynomials of the second order (Mikulášek, 1994). Hence we could apply our newly developed method for an improvement of period of periodically variable stars (Mikulášek, in preparation) to all accessible photometric data with sufficient amplitude of variations/noise ratio. In the total we have used 884 measurements of nine authors (Burke & Howard, 1972; ESA, 1997; Jetsu et al., 1992; Mikulášek et al., 1978; Musielok et al., 1980; Pavlovski, 1979; Pyper & Adelman, 1985; Winzer, 1974; Wolff & Morrison, 1975; this paper) obtained in the u, v, b, U, B, R and H colours, the last being the instrumental colour of the Hipparcos satellite. The whole material more or less uniformly covers the time interval of thirty years or 4457 stellar revolutions.

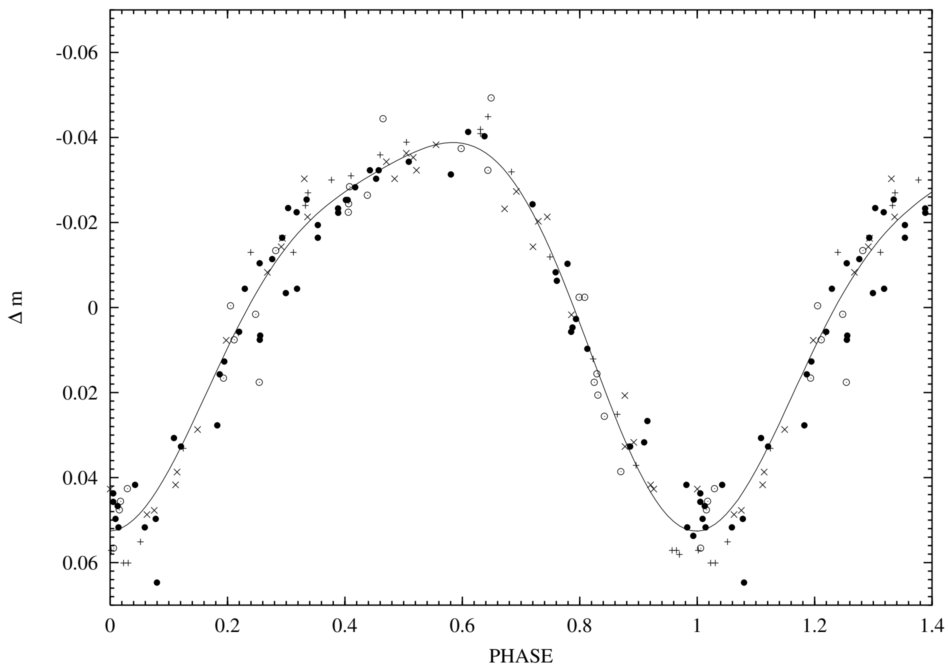

Figure 1. The v light curve of CQ UMa. Smooth line: the fitted light curve. Symbols: ∘ Pyper & Adelman (1985), × Musielok et al. (1980), + Wolff & Morrison (1975), • this paper

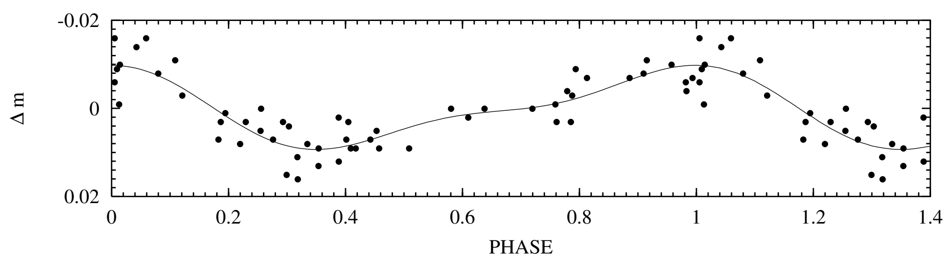

Figure 2. The R light curve of CQ UMa. Dots: observations, smooth line: the fitted light curve

The times of v minima are given by the relation:

$$\mathrm{JD_{hel}}(\mathrm{Min}\ v) = 2445925.4255(37) + (E - 2113) \times 2\overset{\mathrm{d}}{.}4499117(29),$$

the initial epoch ($E = 0$) corresponds to the v colour light minimum immediately preceding the first photometric observation of CQ UMa. The reliability of this ephemeris is extreme, the standard uncertainty of the phase determination being 0.002.

Our new photometry indicates that the period of light variations of the star was stable within the last 30 years, which confirms an incredible stability of photometric patterns on the stellar surface responsible for the light variability.

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NEW W UMa TYPE ECLIPSING BINARIES IN THE GLOBULAR CLUSTER M15

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VAR 1

Name of the object:
W1

Equatorial coordinates:	**Equinox:**
R.A.= $21^{\mathrm{h}}30^{\mathrm{m}}21^{\mathrm{s}}\!.06$ **DEC.=** $+12^\circ 9' 9''\!.3$	2000

VAR 2

Name of the object:
W2

Equatorial coordinates:	**Equinox:**
R.A.= $21^{\mathrm{h}}29^{\mathrm{m}}52^{\mathrm{s}}\!.25$ **DEC.=** $+12^\circ 6' 11''\!.2$	2000

Observatory and telescope:
BOAO (Bohyunsan Optical Astronomy Observatory), 1.8-m reflector ($f/8$, Cassegrain focus)

Detector:	Thinned back illuminated SITe 2048×2048 chip ($11'\!.6 \times 11'\!.6$)

Filter(s):	B, V

Availability of the data:
Through IBVS Web-site as files 5189-t1.txt, 5189-t2.txt, 5189-t3.txt, and 5189-t4.txt

Transformed to a standard system:	Landolt (1992)
Standard stars (field) used:	

Type of variability:	W UMa

Remarks:
Time-series BV CCD photometry was performed over three nights for W1 and nine nights for W2 from 1997 to 2000. Using IRAF/CCDRED package, we processed CCD images to correct overscan regions, trim unreliable subsections, subtract bias frames and correct flat field images. Instrumental magnitudes were obtained using the Point Spread Function fitting photometry routine in IRAF/DAOPHOT package (Massey & Davis 1992). We applied the ensemble normalization technique (Gilliland & Brown 1988, Jeon *et al.* 2001) to standardize the instrumental magnitudes of all stars in the time-series CCD frames. Two new faint ($\langle V \rangle = 20\overset{\mathrm{m}}{.}246$, $\langle B \rangle - \langle V \rangle = 1\overset{\mathrm{m}}{.}014$ & $P = 0\overset{\mathrm{d}}{.}23306$ for W1; $\langle V \rangle = 19\overset{\mathrm{m}}{.}791$, $\langle B \rangle - \langle V \rangle = 0\overset{\mathrm{m}}{.}560$ & $P = 0\overset{\mathrm{d}}{.}23576$ for W2) W UMa type stars in globular cluster M15 were discovered.

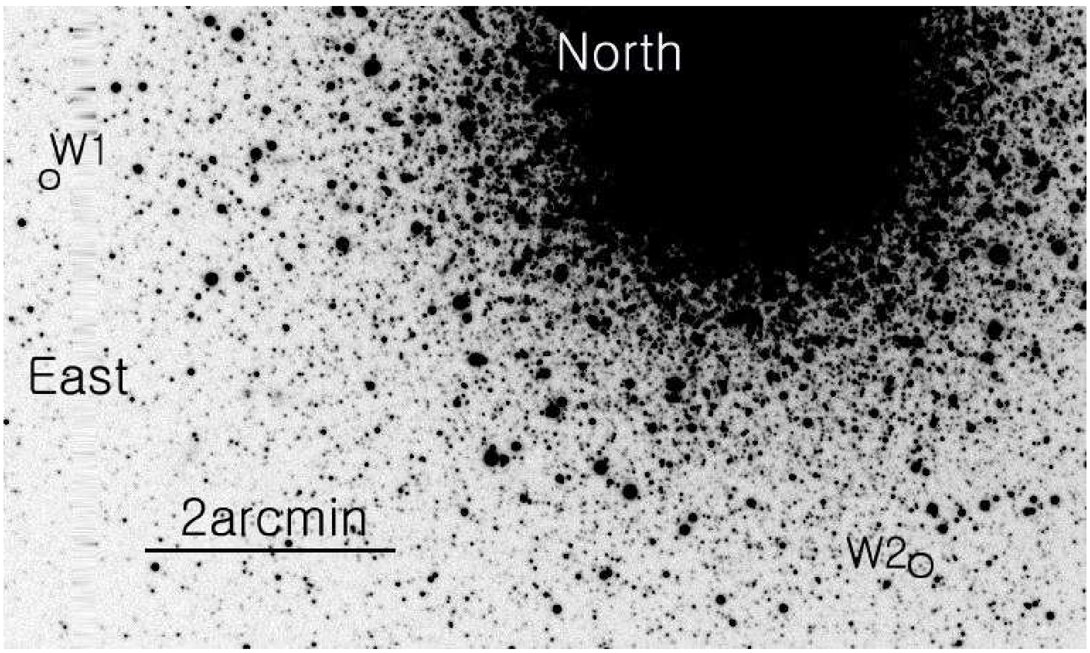

Figure 1. Finding chart of the two W UMa type variable stars, W1 and W2, in globular cluster M15

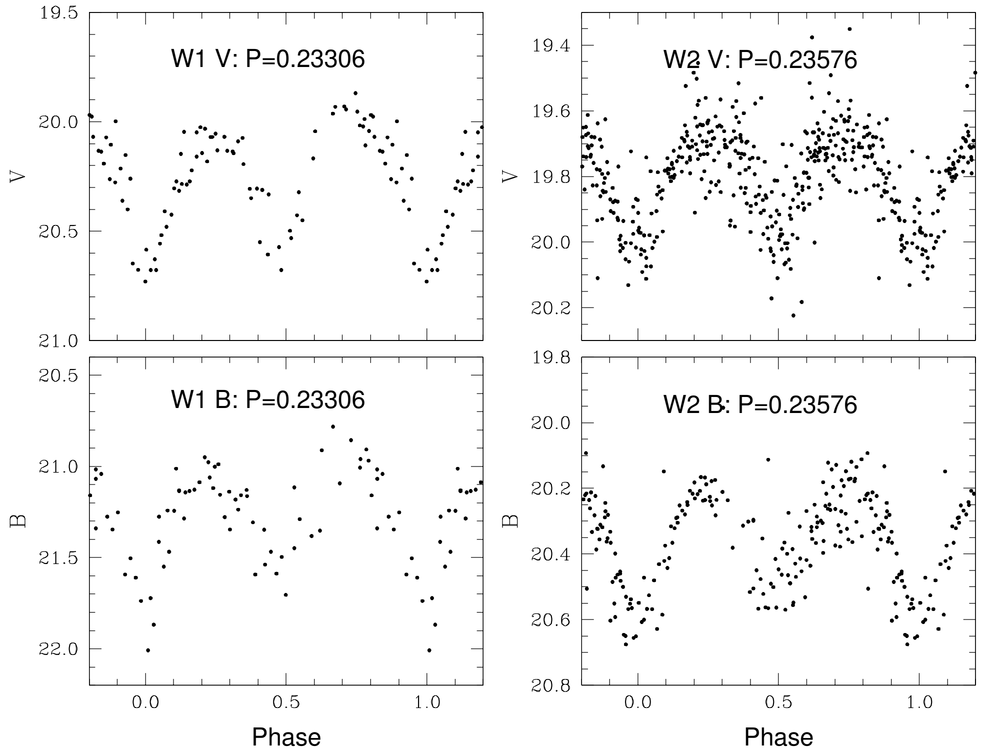

Figure 2. Light curves of the two W UMa type stars

References:

Gilliland, R.L., Brown, T.M., 1988, *PASP*, **100**, 754
Jeon, Y-.B., Kim, S-.L., Lee, H., Lee, M.G., 2001, *AJ*, **121**, 2769
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UBV PHOTOMETRY OF THE W UMa STAR V839 OPHIUCHI

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Name of the object:
V839 Oph = HD 166231 = BD +09°3584

Equatorial coordinates:	**Equinox:**
R.A.= $18^{h}09^{m}21\overset{s}{.}27$ **DEC.=** $+09°09'03\overset{''}{.}6$	2000.0

Observatory and telescope:
51-cm Cassegrain telescope of Biruni Observatory at Shiraz University, Shiraz, Iran

Detector:	Unrefrigerated RCA4509 photomultiplier tube

Filter(s):	U, B and V filters of Johnson system

Transformed to a standard system:	No

Comparison star(s):	BD +09°3589 = HD 166414

Check star(s):	BD +09°3573 = HD 166015

Availability of the data:
Upon request

Type of variability:	W UMa

Remarks:

In this paper we present UBV light curves of V839 Oph, which was discovered to be a W UMa type system by Rigollet (1947). The observations were made during the summer of 2000 (for five nights) with U, B and V filters. The phases of the observations were calculated using the linear part of the light elements given by Akalin & Derman (1997):

$$\mathrm{HJD}_{\mathrm{min\,I}} = 2449536.38555 + 0\overset{\mathrm{d}}{.}4090041886 \times E.$$

Times of minima were determined by Kwee and Van Woerden (1956) method. Table 1 presents the derived times of minima in Heliocentric Julian Date (I for primary and II for secondary) and also $O-C$ were calculated with respect to linear (l), quadratic (q) and sinusoidal (s) ephemeris. The derived light and color curves for U, B and V filters are illustrated in Figure 1.

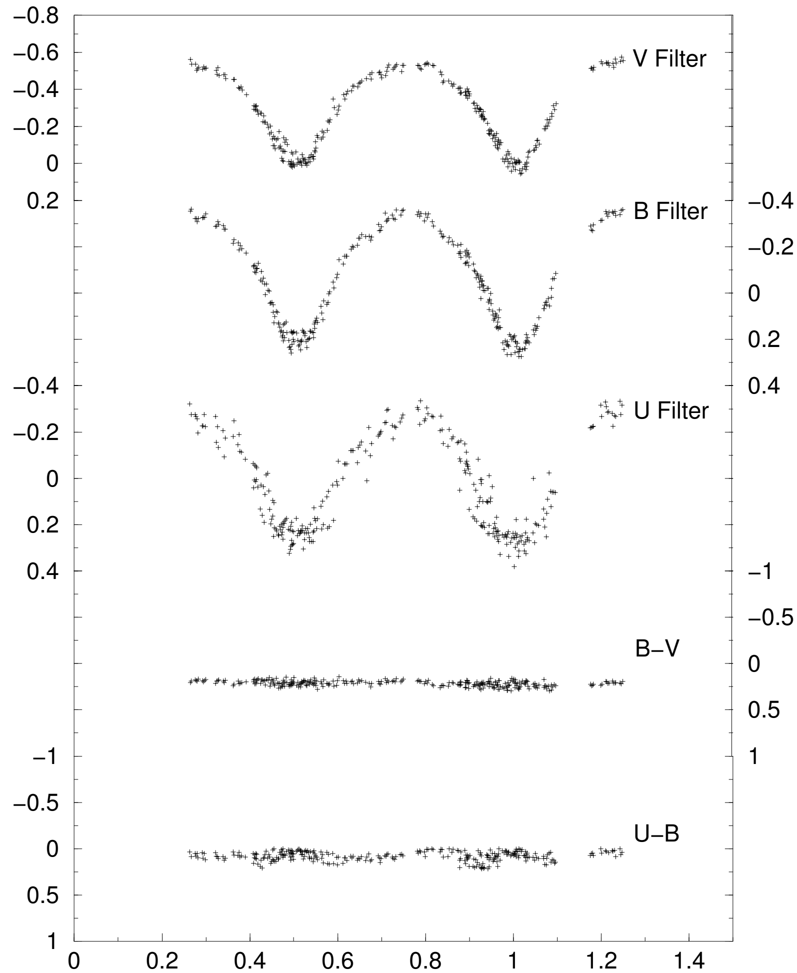

Figure 1. The light and color curves of V839 Oph

Minima times and $O-C$ of V839 Oph

JD Hel. 2400000 +	Min	Error	$(O-C)_l$	$(O-C)_q$	$(O-C)_s$
51745.4208	I	±0.0004	−0.0076	−0.0015	−0.0033
51783.2533	II	±0.0021	−0.0081	−0.0020	−0.0030

Acknowledgements:

This research made use of the SIMBAD database, operated at CDS, Strasbourg, France.

References:

Akalin, A., Derman, E., 1997, *A&AS*, **125**, 407
Kwee K.K., van Woerden H., 1956, *Bull. Astr. Inst. Neth.*, **12**, 327
Rigollet, A., 1947, *l'Astronomie*, **61**, 54

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V842 Her: A W UMa STAR WITH CONSTANT PERIOD

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The poorly-studied variable star V842 Herculis = BD +50° 2255 = NSV 7457 = BV 103 is a late-type contact binary system showing remarkable spot activity (Vandenbroere, 1993, Torres & Melendo, 1996). The light-curve shows the so-called O'Connell-effect (the heights of the two maxima differ from each other, $\Delta V = V_{MaxII} - V_{MaxI}$). Its rate is variable: Vandenbroere (1993) and Torres & Melendo (1996) found $\Delta V = 0\overset{\mathrm{m}}{.}1$ and $\Delta V = 0\overset{\mathrm{m}}{.}03$ magnitudes, respectively. The light curve has been analysed by Torres & Melendo (1996). The radial velocity curve has been constructed by Rucinski & Lu (1999).

According to Filatov (1960) the star was an RR Lyr variable but Vandenbroere (1993) has clearly showed that the object was a W UMa star. Vandenbroere (1993) also reviewed the history of the star by 1993, and suspected a period increase. Filatov (1960) published several moments of maxima and based on these moments Vandenbroere (1993) found the following ephemeris

$$\mathrm{Max} = \mathrm{HJD}\ 2430850.002 + 0\overset{\mathrm{d}}{.}4190076 \times E \tag{1}$$

valid for 1943-1959. For the early 1990s Vandenbroere (1993) obtained the following ephemeris from her own new observations:

$$\mathrm{Min} = \mathrm{HJD}\ 2447643.1786 + 0\overset{\mathrm{d}}{.}4190306 \times E \tag{2}$$

This period is longer by almost 2 seconds than that of given by Eq. (1).

Later, Torres & Melendo (1996) published a different ephemeris based on their 1996 observations:

$$\mathrm{Min} = \mathrm{HJD}\ 2450177.4767 + 0\overset{\mathrm{d}}{.}41906 \times E \tag{3}$$

which period is again longer than the previously mentioned ones.

Since these values suggest about 30 sec/century period variation we decided to observe the system. Note that the highest rates of similar long term period increases in W UMa stars are 2.7 seconds/century for V839 Oph (Wolf et al., 1996), 3.1 seconds/century for UZ Leo (Hegedüs & Jäger, 1992) and 5.3 seconds/century for XY Boo (Molík & Wolf, 1998).

V842 Herculis was observed on four nights in April and May, 2000 with the 60/90/180 cm Schmidt-telescope of Konkoly Observatory. The detector is described in Bakos (1998). The CCD-frames were corrected for cosmic-ray events, and they were bias-subtracted and flat-fielded. Individual instrumental magnitudes were determined by the IRAF/DAOPHOT package. The following stars were used as comparison stars: GSC 3497-31, 3497-51, 3497-239, 3497-346 and 3497-349. The data can be requested from the author.

List of the available minima (visual and CCD ones) and the corresponding $O - C$ values are found in Table 1.

In two cases we had to change the type of minima from primary to secondary or vice versa, because the published types seemed to be wrong. The period was constant between JD 2 490 000 and JD 2 452 000. New ephemeris was determined based on CCD/PE minima tabulated in Table 1:

$$\text{Min I} = \text{HJD } 2450177.48(16) + 0.419037(9) \times E \qquad (4)$$

and the corresponding residuals are listed in Table 1 as $O - C_1$. Note that the period remains the same when all minima are taken into account. Since period variation was suspected, a parabolic ephemeris was also computed using CCD/PE minima:

$$\text{Min I} = \text{HJD } 2450177.48(02) + 0.419035(8) \times E + 1.047 \cdot 10^{-9} \times E^2 \qquad (5)$$

The corresponding residuals are listed in Table 1 as $O - C_2$. This ephemeris would yield a rate of period variation of ~ 8 sec/century.

In the following analysis only the CCD/PE minima were used. The sum of squares of residuals is $5.7 \cdot 10^{-4} d^2$ and $4.1 \cdot 10^{-4} d^2$ for the linear and the parabolic ephemeris, respectively. In the case of the parabolic representation, one can estimate the period to be 0.4190206 at the time of Filatov's observations (see above). Thus, there is a 1 second discrepancy between this estimation and the period determined by Vandenbroere (1993) for that time.

Taken into account this, and the fact that the sums of squares of residuals are not significantly different for linear and parabolic approximations, we can state that the period of V842 Her has been constant in the last decade. However, sudden period change or changes in the past cannot be excluded. To solve the question of the period variation of this rather bright system further accurate CCD observations are needed.

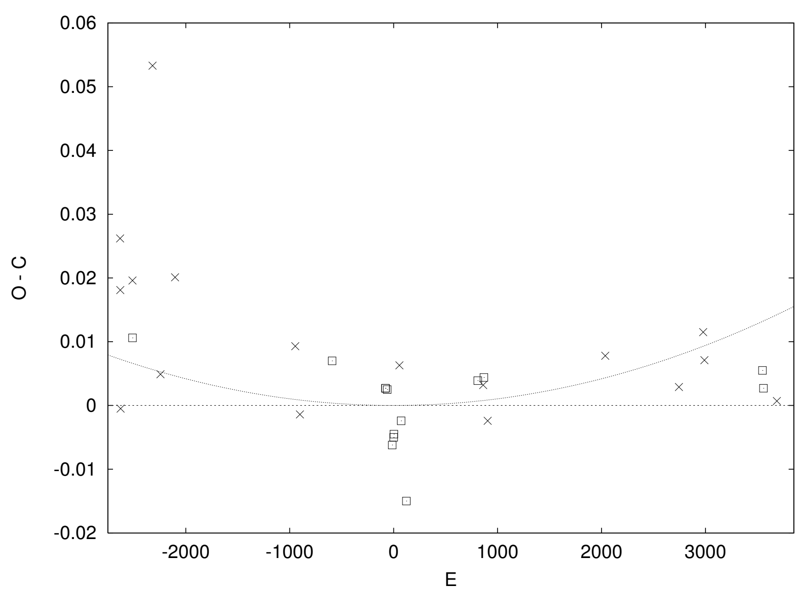

Figure 1. O-C diagram of V842 Herculis. Squares and crosses are denoting CCD and visual minima, respectively. Dotted line: linear ephemeris (Eq. (4)), solid line: parabolic ephemeris (Eq. (5)).

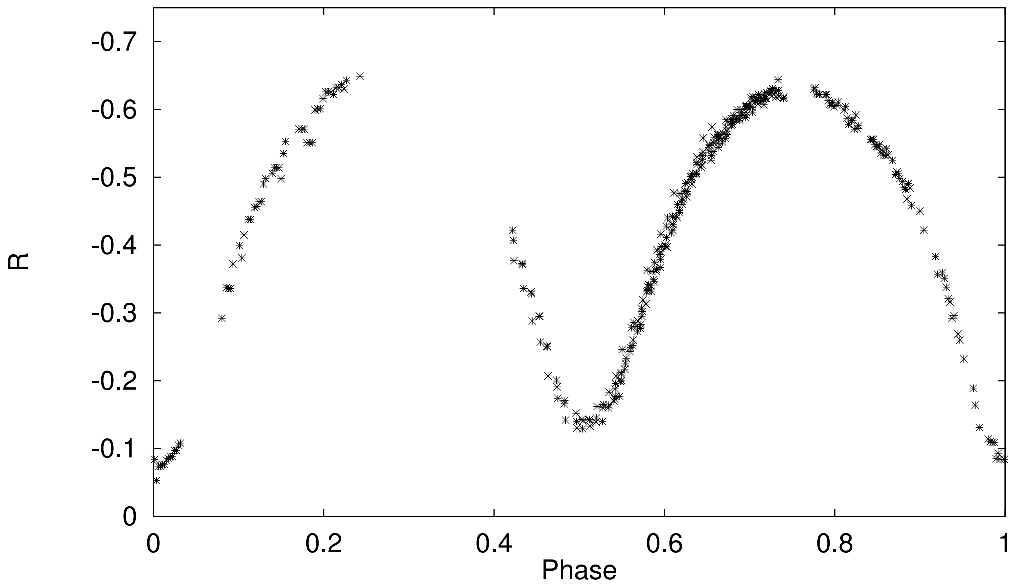

Figure 2. Differential R light curve of V842 Her.

Acknowledgements. I thank Mrs J. Vandenbroere, Mr J.N. Torres, Mr E. G. Melendo for sending their data to me. This work was supported by the OTKA Grant T034551.

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Diethelm, R., 1994, *IBVS*, No. 4011
Filatov, G.S., 1960, Astr. Circular, No. 215
Hegedüs T., Jäger Z., 1992, *PASP* **104**, 733
Melendo, E. G., Torres, J. N., 2000, private communication
Molík, P., Wolf, M., 1998, *IBVS*, No. 4640
Rucinski, S. M., Lu, W., 1999, *AJ*, **118**, 2451
Torres, J. N., Melendo, E. G., 1996, *IBVS*, No. 4365
Vandenbroere, J., 1993, *IBVS*, No. 3946
Vandenbroere, J., 2000, private communication
Wolf, M., Ŝarounová L., Molík P., 1996, *IBVS*, No. 4304

Table 1: List of minima of V842 Herculis

$Min_{HJD}-$ -2400000	E	Type of obs.	Error	$O-C_1$	$O-C_2$	Reference
49074.600	−2632	vis	0.004	+0.026	+0.015	BBSAG 105
49075.430	−2630	vis	0.002	+0.018	+0.007	”
49076.459	−2627.5	vis	0.003	−0.001	−0.012	”
49124.459	−2513	vis	0.001	+0.020	+0.009	”
49124.65948	−2512.5	PE	0.00012	+0.0106	+0.0001	Diethelm, 1994
49205.367*	−2320	vis	0.006	+0.053	+0.044	BBSAG 105
49237.375	−2243.5	vis	0.005	+0.005	−0.004	”
49296.265	−2103	vis	0.003	+0.020	+0.013	BBSAG 107
49780.662	−947	vis	0.002	+0.009	+0.008	BBSAG 110
49799.508	−902	vis	0.004	−0.001	−0.003	”
49929.4182	−592	CCD	0.0012	+0.007	+0.009	BBSAG 109
50144.3803	−79	CCD		+0.0027	+0.0039	Agerer & Huebscher, 1997
50144.5898	−78.5	CCD		+0.0027	+0.0039	”
50151.5038	−62	CCD		+0.0025	+0.0038	”
50171.6089	−14	CCD	0.0002	−0.0062	−0.0048	Melendo & Torres, 2000
50177.4766	0	CCD	0.0004	−0.0050	−0.0036	”
50178.5247	2.5	CCD	0.0004	−0.0045	−0.0031	”
50200.535	55	vis	0.003	+0.006	+0.008	BBSAG 115
50207.4404	71.5	CCD	0.0004	−0.0024	−0.0009	Melendo, 2000
50228.5892	122	CCD	0.0027	−0.0150	−0.0134	”
50516.4872	809	CCD	0.0005	+0.0039	+0.0064	Agerer & Huebscher, 1998
50538.486	861.5	vis	0.006	+0.003	+0.006	BBSAG 115
50541.4204	868.5	CCD	0.0010	−0.0044	+0.0068	Agerer & Huebscher, 1998
50556.499	904.5	vis	0.002	−0.002	+0.0001	BBSAG 116
51030.441	2035.5	vis	0.005	+0.008	+0.009	BBSAG 121
51327.534*	2744.5	vis	0.004	+0.003	+0.002	”
51425.388	2978	vis	0.003	+0.012	+0.001	”
51430.412	2990	vis	0.004	+0.007	+0.005	”
51664.4431	3548.5	CCD	0.0002	+0.0054	+0.0012	this paper
51668.4211	3558	CCD	0.0006	+0.0026	−0.0017	”
51722.475	3687	vis	0.003	+0.001	−0.004	Vandenbroere, 2000

Abbreviations: vis: visual, PE: photoelectric

Asterisk means that published type of minimum was changed.

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CCD LIGHT CURVES OF ROTSE1 VARIABLES, XII: GSC 3073:837 Her, ROTSE1 J171239.42+330800.2 Her, GSC 2604:1671 Her AND GSC 3094:120 Her

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VAR 1:

Name of the object:
GSC 3073:837 = ROTSE1 J171017.73+382639.0

Equatorial coordinates:	**Equinox:**
R.A.= $17^h10^m17.7^s$ **DEC.=** $+38°26'39''$	2000.0

Comparison star(s):	GSC 3072:1886

Check star(s):	GSC 3072:1726

VAR 2:

Name of the object:
ROTSE1 J171239.42+330800.2

Equatorial coordinates:	**Equinox:**
R.A.= $17^h12^m39.4^s$ **DEC.=** $+33°08'00''$	2000.0

Comparison star(s):	J171233.92+330640.5

Check star(s):	J171228.03+330541.8

VAR 3:

Name of the object:
GSC 2604:1671 = ROTSE1 J171839.88+355423.8

Equatorial coordinates:	**Equinox:**
R.A.= $17^h18^m39.9^s$ **DEC.=** $+35°54'24''$	2000.0

Comparison star(s):	GSC 2604:897

Check star(s):	GSC 2604:857

VAR 4:

Name of the object:
GSC 3094:120 = ROTSE1 J172023.86+411515.3

Equatorial coordinates:	**Equinox:**
R.A.= $17^h20^m23.9^s$ **DEC.**= $+41°15'15''$	2000.0

Comparison star(s):	GSC 3077:591

Check star(s):	GSC 3094:80

Observatory and telescope:
Private observatory Schüsselacher, Wald, 0.15-m Starfire refractor

Detector:	SBIG ST-7 CCD camera

Filter(s):	None

Availability of the data:
Upon request from diethelm@astro.unibas.ch

Type of variability:	EW

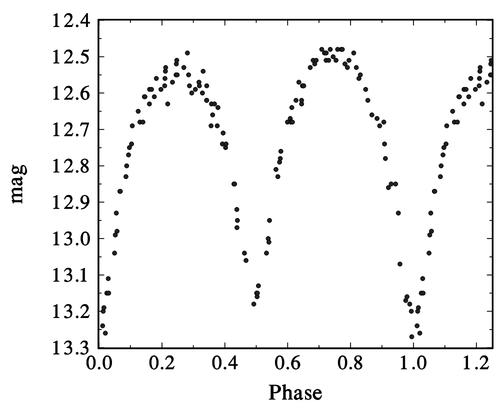

Figure 1. CCD light curve (without filter) of GSC 3073:837

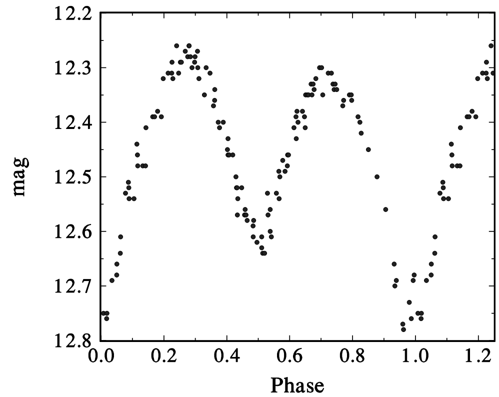

Figure 2. CCD light curve (without filter) of ROTSE1 J171239.42+330800.2

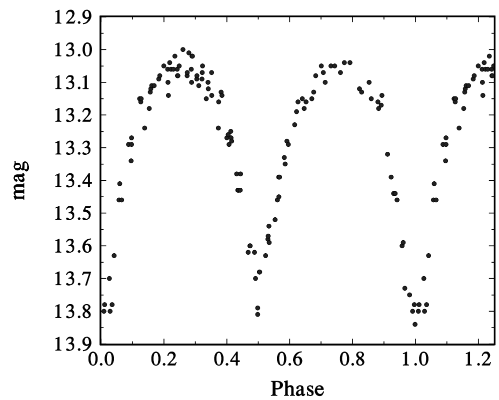

Figure 3. CCD light curve (without filter) of GSC 2604:1671

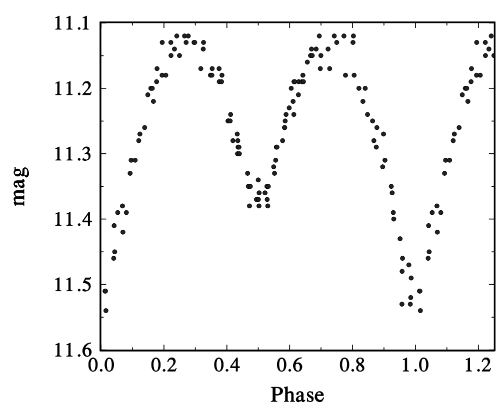

Figure 4. CCD light curve (without filter) of GSC 3094:120

Remarks:

As a byproduct of the ROTSE1 CCD survey, a large number of new variables have been discovered (Akerlof et al., 2000). In a series of papers, we report unfiltered CCD observations for some of the close binary systems (type EW) in the list of Akerlof et al. (2000). This installment contains information on four variables in the constellation Herculis. The four stars were observed with our CCD equipment as mentioned above during 7 nights between JD 2452056 and JD 2452082. A total of 136 CCD frames were measured of GSC 3073:837 (VAR 1), 134 frames of ROTSE1 J171239.42+330800.2 (VAR 2), 130 frames of GSC 2604:1671 (VAR 3) and 131 frames for GSC 3094:120 (VAR 4). Figures 1 through 4 show our observations folded with the elements:

GSC 3073:837:	JD(min,hel) $= 2452065.5005 + 0.240641 \times E$;
ROTSE1 J171239.42+330800.2:	JD(min,hel) $= 2452073.3641 + 0.320737 \times E$;
GSC 2604:1671:	JD(min,hel) $= 2452056.3941 + 0.287848 \times E$;
GSC 3094:120:	JD(min,hel) $= 2452056.3775 + 0.315408 \times E$.

These elements of variation are deduced from a linear fit to the normal minima from the ROTSE1 data (Diethelm, 2001) and the timings of minimum derived from our data given in Blättler (2001).The light curve of ROTSE1 J171239.42+330800.2 is somewhat unusual because of the marked difference in the depth of the two minima (0.12 mag) as well as the O'Connell effect. This variable is situated in a GSC "blind spot".

Acknowledgements:

This research made use of the SIMBAD data base, operated at CDS, Strasbourg, France

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Blättler, E.; 2001, *BBSAG Bulletin*, **126** in preparation

Diethelm, R.; 2001, *IBVS*, No. 5060

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EMISSION ACTIVITY OF THE Be STAR 28 CMa: ENTERING A NEW CYCLE?

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The bright southern Be star 28 CMa (HR 2740, HD 56139) is proto-typical of the spectroscopic and photometric variability of Be stars. New modeling techniques have been tested on it. Very conspicuous line profile variations (*lpv*) with a period of 1.37 d were discovered by Baade (1982a). A detailed description of the *lpv* of He I 6678 was presented by Štefl et al. (1999), and advanced non-radial pulsation models for different spectral lines were computed by Maintz et al. (2000). Although rapid light variations have been known almost equally early (Baade, 1982b), the derived periods were questionable and inconsistent with the spectroscopic one. Štefl et al. (1999) analysed the Strömgren and Geneva photometry obtained during 16 years and isolated the 1.37 d periodic component of the light variations, whose amplitude is variable from season to season and reaches only a few mmag. These rapid periodic variations are combined with much larger variations on time scales of weeks to years. The latter are probably connected with the photospheric activity of the star as well as with restructuring in the circumstellar disk. A large brightening by about $0\overset{m}{.}4$ was observed by Hipparcos in 1992. New observations show that an emission outburst of a comparable intensity started in 2001.

Visual observations since 1997 April and the 1990-1993 Hipparcos database reveal that the photometric ground state of 28 CMa corresponds to a magnitude of $\sim 4\overset{m}{.}05$ visually or $\sim 3\overset{m}{.}98$ in the Hipparcos broad photometric band. Superimposed on this plateau are fluctuations, mainly in the form of brightenings by up to 0.1 mag. The most recent brightening, which started in 2001 March and reached about $3\overset{m}{.}8$ in June, has a significantly larger amplitude. First visual observations revealing the strength of this new outburst were obtained by E. De Bernardini (Buenos Aires) on Oct. 13, 2001 and confirmed by SO on Oct. 19. The star reached $V_{vis} = 3\overset{m}{.}67$. The rising branch of the 2001 light curve resembles the one during the 1992 Hipparcos outburst (see Fig. 1). The most recent observations from the end of October 2001 seem to indicate that the outburst has already reached the descending branch.

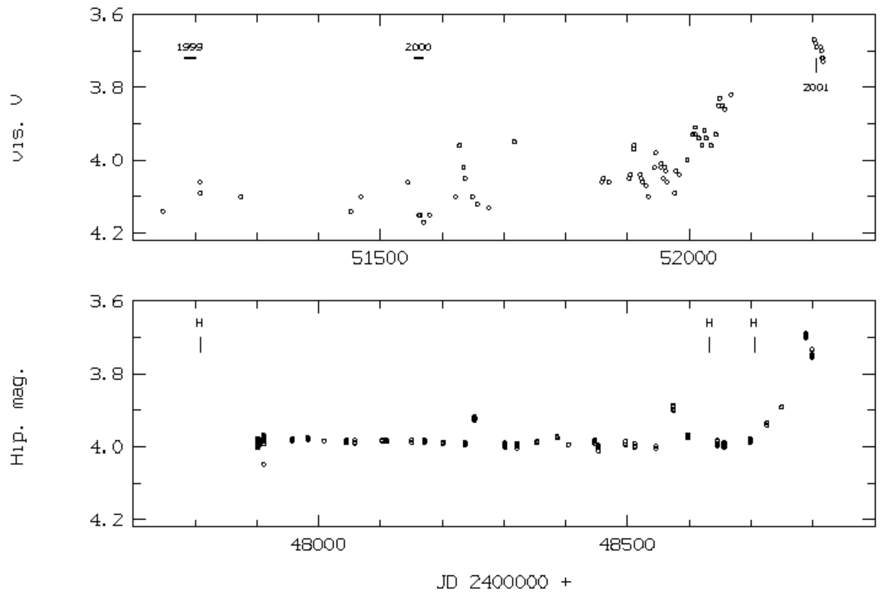

Figure 1. The strongest emission outbursts of 28 CMa observed during the past decade: the 1992 event covered by Hipparcos (lower panel, Perryman 1997) and the 2001 outburst documented by visual observations by SO (upper panel). The uncertainty of the visual magnitudes is 0.05-0.10 mag before HJD 2451900 and 0.03-0.05 mag thereafter. The times of Hα observations by Hanuschik et al. (1996) are indicated in the upper part of the lower panel. Intervals of the spectroscopic observing runs used in Fig. 2 are marked in a similar way in the upper panel.

Three high-resolution spectra obtained on October 23 and 24, 2001 with the FEROS echelle spectrograph and fiber link to the ESO 1.5-m telescope on La Silla confirm a strong outburst event. The total equivalent width of the Balmer emission lines dropped significantly (which is partly due to the strong increase in the continuum flux). But the strength of the wings increased with respect to previous years. The Hα peak height, E/C, of ≈ 3.0 is among the lowest values ever observed (see Fig. 2 and Harmanec, 1998). The shoulders in the emission profile have disappeared and the previous typical wine-bottle shape is no longer there. The other Balmer lines, particularly Hβ and Hδ, show an asymmetric structure in their cores. By contrast, intensity of metal emission lines increased only little and their peak separation did not change compared to January 2000 spectra (see Rivinius et al., 2001; Fig. 1). No emission is detectable in the wings of He I lines.

The two panels of Fig. 1 indicate that emission outbursts appear on a time scale of 200-350 days, in agreement with Hubert and Floquet (1998). Nevertheless, the outbursts around JD2448800 (1992) and 2452000 (2001) differ substantially in their dimensions. Both photometry and spectroscopy show that the recent outburst lasts several times longer and has a larger amplitude. There is intriguing evidence that another strong outburst took place on JD2445200-300. It is indicated by a $0\overset{m}{.}4$ brightening in the Strömgren b-band (see, e.g., Fig. 7 of Harmanec, 1998) and an accompanying state of low Hα emission (Hanuschik et al., 1996). Considering also the Hipparcos outburst, it appears that such

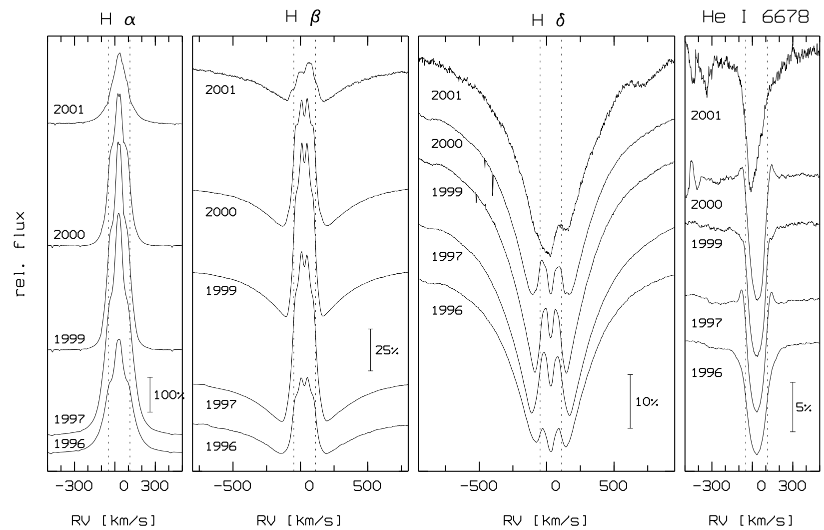

Figure 2. Comparison of mean emission profiles of selected spectral lines in the 1996, 1997, 1999, 2000 and 2001 (from Štefl et al., in preparation). A more careful inspection shows a higher emission in the wings of Hβ and Hδ lines in 1996 and 2001, when outbursts took place. Due to the large number of spectra, the strong 1.37-d *lpv*, which causes the asymmetry in the 2001 H I lines, is averaged out in the 1996 - 2000 mean spectra. The sharp features to the left of the He I line in the 2000 and 2001 spectra are due to a detector blemish. Dotted lines indicate the values of the systemic velocity $\pm\, v \sin i$. The bars to the right provide the flux scales in units of the local continuum; note the differences between individual panels.

major events take place once in 10 years; possibly they are even repetitive on a time scale of 3400-3600 days.

Analysis of the 1996 outburst (Štefl et al., in preparation) shows that 28 CMa follows the general scheme derived from line emission outbursts of μ Cen (Rivinius et al., 1998; Baade et al., 2001) but on a time scale, which is longer by at least one order of magnitude. This scheme consists of four phases: relative quiescence, precursor, outburst proper and relaxation, which are so far defined only spectroscopically. Because no spectra of 28 CMa are available for the time between February, 2000 and October, 2001, it is difficult to determine the present phase of the 2001 outburst. Based on the line emission being close to a minimum, on the missing emission in He I lines, and on the relatively high separation of emission peaks in metal lines, one may crudely guess that the outburst is in the late precursor or early outburst phase. Provided that it started in 2001 May or earlier, it develops very slowly in comparison with smaller outbursts in 28 CMa itself but also in other Be stars such as μ Cen.

If this large outburst does indeed fit the same scheme, the spectral evolution over the next weeks to months might be as follows: In the Balmer emission lines, the peak height will steadily increase while the wings will fade. At the same time, the emission will increase in the wings of He I and metal lines. The separation of emission peaks of metal lines will decrease. A double structure of the blue and red peaks may develop for a limited time until the inner part of the disk is formed. The coexistence of two pairs of emission peaks may reflect a double-ring structure of the disk as suggested recently by Rivinius et al. (2001). One may also expect the appearance of transient periods (Štefl et al. 1998, 2000), which were already observed after the weaker 1996 outburst. They may be echos of the photospheric oscillations in the inner disk. Finally, the visual magnitude will asymptotically approach its base value near $4.^m0$.

28 CMa is a pole-on star (e.g., Maintz et al., 2000) and therefore provides a nice illustration of the rule (e.g., Harmanec, 1983; Hubert & Floquet, 1998) that during outbursts such stars brighten whereas equator-on Be stars get fainter.

The present strong outburst of this bright star offers considerable opportunities: (a) If it can be confirmed that such major and the more frequent minor outbursts mainly differ in their dimensions, this might place important constraints on the unknown physics of outbursts. (b) The slow evolution permits the outburst to be studied in much detail. (c) The most exciting aspect of the latter would be to see whether during the course of an outburst the nonradial pulsation exhibits any changes. (d) Contemporaneous photometry and spectroscopy can be arranged for, which could be important to elucidate the photometric aspects of Be star outbursts.

Acknowledgements. We thank Dr. Luca Pasquini, for the kind permission to take the October, 2001 spectra within the framework of his ESO project No. 68.D-0334. S. Š appreciates the support of the Grant Agency of the Academy of Sciences of the Czech Republic (grant no. AA3003001).

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6 November 2001

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GSC 608_143: A NEW W UMa VARIABLE

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Name of the object:
GSC 608_143

Equatorial coordinates:	**Equinox:**
R.A.= $00^h59^m50\overset{s}{.}10$ **DEC.=** $+12°25'03\overset{''}{.}8$	J2000

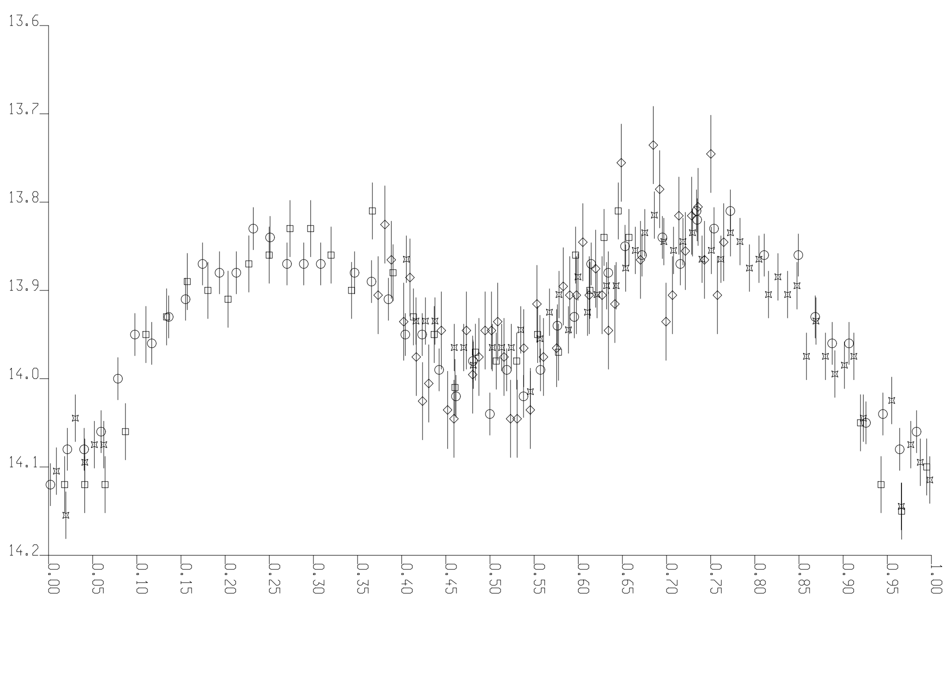

Figure 1. Unfiltered lightcurve of GSC 608_143

Observatory and telescope:
Les Engarouines Observatory (IAU astrometric code 164), 0.212m Newton telescope Blauvac Observatory (code 627), 0.257m Newton telescope Village-Neuf Observatory (code 138), 0.20m Schmidt–Cassegrain telescope

Detector:	KAF 1600 CCD at 164, KAF 400 CCD at 627, KAF 401e CCD at 138

Filter(s):	None, roughly R

Transformed to a standard system:	No

Availability of the data:
Upon request

Remarks:

The variability of GSC 608_143 was found by Bernasconi from unfiltered CCD frames obtained around 2001-09-18 (circles in Figure 1) for the successful determination of the asteroid (2052) Tamriko light curve. Further observations were obtained by Roy (2001-10-01, diamonds), Demeautis (2001-10-03 near the full moon, and 2001-10-12, stars) and Bernasconi (2001-10-13, squares) for the confirmation of the preliminary light curve and the accurate determination of the period. A sixth order Fourier polynomial with adjustable period was fitted on the observations, using the `CourbRot` software (Behrend, 2001). The resulting light curve is shown in Figure 1. The numerical values are as follows:

$$\begin{aligned}\text{HJD of a principal minimum} &= 2452185.0022 \pm 0.0011\\ \text{Period} &= 0.316657 \pm 0.000019\,\text{d}\\ \text{Total variation} &= 0.27 \pm 0.01\,\text{mag}\end{aligned}$$

The shape of the light curve indicates that the variability type of GSC 608_143 is probably W UMa.

Acknowledgements:

We thank Dr. F. Barblan and Dr. M. Grenon for introducing us to the world of variable stars' light curves.

Reference:

Behrend, R.; 2001, *Orion* **304**, 12

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THE HISTORICAL, 1889-2002, LIGHT CURVE OF THE ECLIPSING SYMBIOTIC BINARY AR Pav

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AR Pavonis is an eclipsing symbiotic binary with an orbital period of 605 days (Mayall 1937). It consists of a M5 III giant (Mürset & Schmid 1999) with a mass of $\sim 2\,M_\odot$ (Schild et al. 2001). The nature of the hot companion is under discussion. The presence of a large accretion disk around a main sequence star was suggested by Kenyon & Webbink (1984) and Skopal et al. (2000a), but, in contrast, Schild et al. (2001) considered a possibility that the hot component is a white dwarf and the red giant underfills its Roche lobe. According to the observed variations in the UV/optical continuum (e.g. Schild et al. 2001, Skopal et al. 2000a), the hot eclipsed object is highly variable in brightness, size and geometry. Photometric activity of AR Pav has been recorded since 1889 (Mayall 1937). The top panel of Fig. 1 shows its historical 1889.5–2001.8 photographic/B-band/visual light curve (LC). The $m_{\rm pg}/B$-band LC is characterized by about 2 mag deep minima – eclipses – and strong out-of-eclipse variations between about 12 and 10 mag, which peaked at $\sim 9^m$ in 1900 and 1935 active phases. The visual LC documents the evolution since 1982.2. It completely covers the 1985-1999 active phase. Dramatic out-of-eclipse variations in this part of the LC were interpreted as a result of variable mass transfer from the red giant (Bruch et al. 1994) and/or by an impact of the ejected material from the hot star to the facing red giant hemisphere (Skopal et al. 2000a).

Our new photographic magnitudes were obtained by measuring a total of 137 plates collected in the archive of the Bamberg Observatory. They cover the period 1963.5 to 1971.5. The magnitudes were estimated by eye at a microscope using the photoelectric sequence provided by Kilkenny (1988). For each plate we made a few independent estimates. It was possible to achieve an accuracy of about 0.1 mag. The data are summarized in Table 1 and plotted in Fig. 1. Compared are photoelectric B magnitudes of Andrews (1974), which confirm the high accuracy of our photographic estimates. This suggests that variations of ≥ 0.1 mag can be considered as real. Our data indicate rather irregular brightness changes from cycle to cycle with an increasing trend from epoch E=45 to E=48 (Fig. 2, left panel). We believe that a variable mass transfer governs this kind of irregular changes. In addition, a flat maximum can be recognized between 1969 and 1971 (Fig. 1, mid). This might be of the same nature as those observed in the Mayall's LC, suggesting a periodicity of 7-10 years (cf. Fig. 1, top).

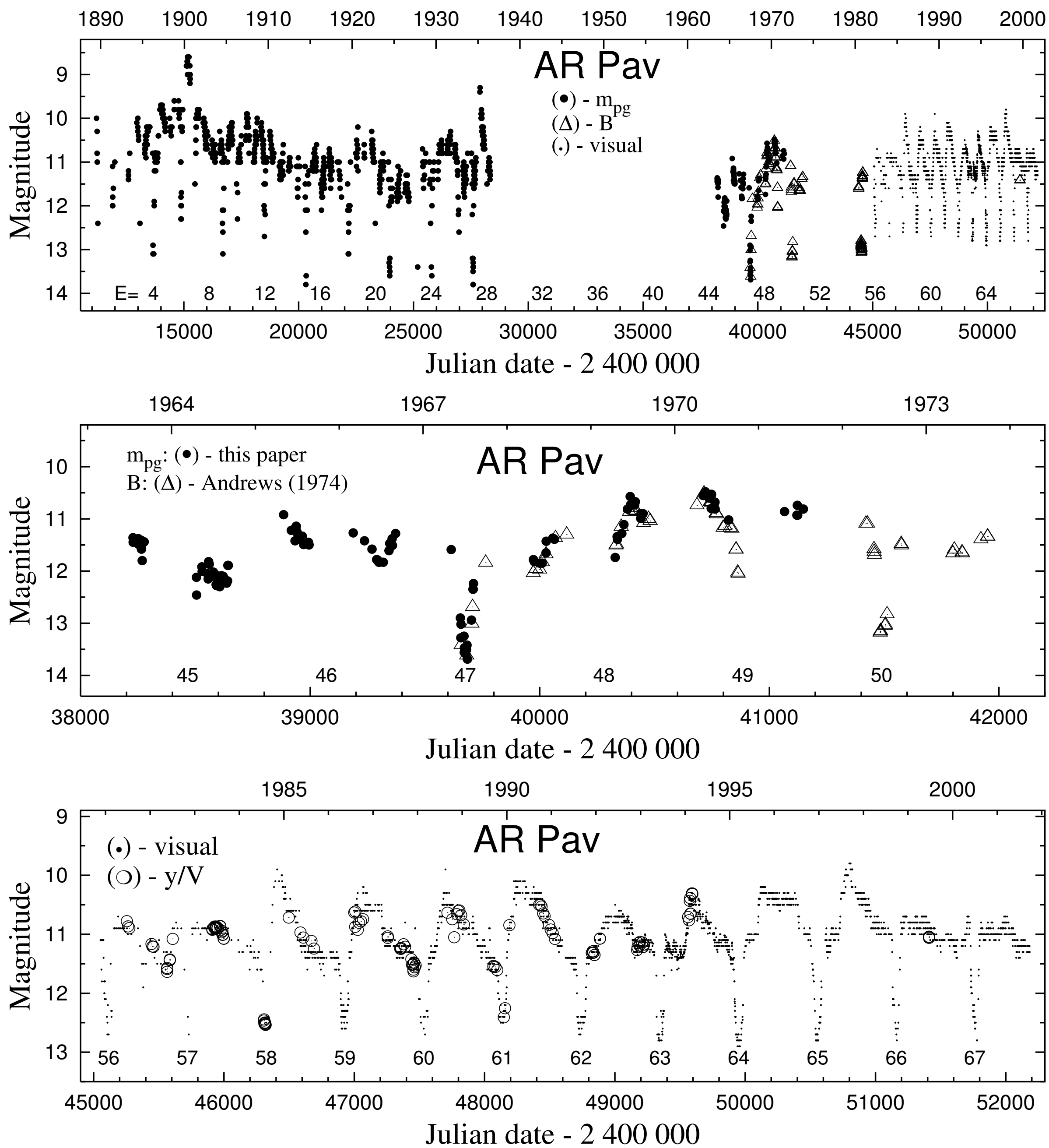

Figure 1. The historical 1889.5–2001.8 photographic/B-band/visual LC of AR Pav. It is compiled from photographic data of Mayall (1937), those presented in this paper, B-band photoelectric measurements as published by Andrews (1974) and Menzies et al. (1982), and the visual estimates made by one of us (AJ). **Middle:** A part of the LC between 1963.5 and 1973.7 composed of our photographic magnitudes and B-band photoelectric measurements by Andrews (1974). Note the very good agreement between these data sets. **Bottom:** Our visual estimates, which document the photometric evolution from 1982.2 to date. Compared are y-band photoelectric measurements obtained during the LTPV program at ESO (Manfroid et al. 1991, Sterken et al. 1993) and V-band photometry (around JD 2 451 410) published by Skopal et al. (2000b). Also in this case, agreement between these data sets is excellent. Epochs E are given according to the average linear ephemeris of the minima, $Min = JD\ 2\,411\,265.9 + 604.46{\times}\mathrm{E}$ (Skopal et al. 2000a).

Our new visual estimates cover the period from epoch 66 (1998.9, cf. Fig. 1). They were carried out by one of us (AJ) with a private 12.″5 f/5 reflector using the comparison sequence of Kilkenny (1989). They are shown in the bottom panel of Fig. 1. Comparison of the photoelectric y and V magnitudes testifies the high quality of the visual observations. Our data show that the active phase of AR Pav suddenly ended at the beginning of epoch 66. No brightening was observed from this epoch to date. To demonstrate basic changes of the hot object between activity and the present quiescence, we folded the data according to the average ephemeris of the minima (Skopal et al. 2000a) and, as an example, selected those at E=62 and E=66 (Fig. 2, right panel). The E=66 minimum is narrower by about 16 days, deeper by ≈ 0.5 mag with approximately the same level of minimum light, and shifted by about -1.4 days with respect to the minimum at E=62. In addition, a sharp profile of the recent minima at E=66 and 67 with a stillstand at $\varphi \sim 0.96$ is very similar to that observed during the quiescent phase between the epoch 0 and 28 (cf. Fig. 8 of Skopal et al. 2000a). Finally, we determined positions of the recent two minima to Min(66) = JD2 451 158.9±0.7 and Min(67) = JD2 451 762.8±0.7. Combining these positions with those published by Skopal et al. (2000a) allows us to slightly refine the average linear ephemeris of all available mid-points of eclipses between E=4 and 67 to

$$Min = JD\,2\;411\,266.1 + 604.45(\pm 0.02) \times E.$$

The mid points of the last two minima suggest a period of 603.9 ± 0.5 days, which is consistent with the real period change derived by Skopal et al. (2000a). However, observations of further minima are needed to reduce the uncertainty.

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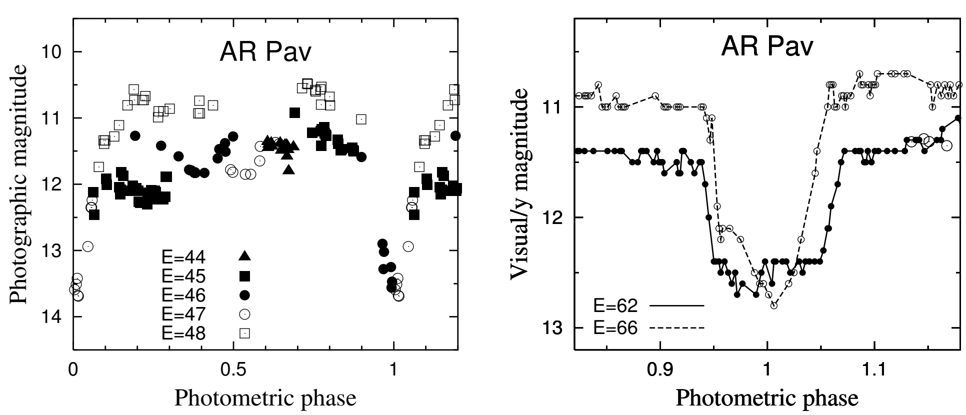

Figure 2. Phase diagrams of our photographic magnitudes (left) and visual estimates at E=62, 66 (right).

Table 1: New photographic magnitudes of AR Pav.

JD 24...	m_{pg}	JD 24...	m_{pg}	JD 24...	m_{pg}	JD 24...	m_{pg}
38228.366	11.36	38589.341	12.10	39236.440	11.42	40027.028	11.65
38229.363	11.45	38590.340	12.26	39269.497	11.58	40028.042	11.43
38230.364	11.40	38592.337	12.28	39289.447	11.78	40056.958	11.37
38233.310	11.42	38606.317	12.30	39291.434	11.79	40063.913	11.39
38234.360	11.40	38607.299	12.16	39293.431	11.79	40328.188	11.74
38235.326	11.38	38608.298	12.13	39299.431	11.83	40337.205	11.34
38236.319	11.43	38613.299	12.09	39300.410	11.82	40338.172	11.39
38252.269	11.38	38614.301	12.12	39301.419	11.83	40340.180	11.34
38254.274	11.49	38615.301	12.20	39318.358	11.83	40357.149	11.28
38257.267	11.45	38618.306	12.23	39343.309	11.61	40366.119	11.11
38258.267	11.46	38620.271	12.10	39346.267	11.47	40382.065	10.81
38260.270	11.46	38621.292	12.12	39357.254	11.38	40394.011	10.57
38261.269	11.41	38622.270	12.12	39358.237	11.51	40395.021	10.73
38264.225	11.41	38636.219	12.23	39372.236	11.28	40410.005	10.73
38265.223	11.58	38640.219	12.19	39614.547	11.59	40412.983	10.73
38266.269	11.43	38641.222	11.89	39654.042	12.90	40415.955	10.67
38267.221	11.48	38643.222	11.89	39656.042	13.28	40439.913	10.99
38268.226	11.80	38884.547	10.92	39657.028	13.02	40440.916	10.90
38277.224	11.44	38917.454	11.22	39669.994	13.25	40449.881	10.90
38504.572	12.12	38933.399	11.20	39671.014	13.56	40711.194	10.55
38505.574	12.46	38934.396	11.42	39672.021	13.47	40721.113	10.48
38528.513	11.92	38935.406	11.17	39677.969	13.59	40722.124	10.49
38529.514	12.01	38939.399	11.14	39680.979	13.51	40736.073	10.58
38553.462	12.05	38940.404	11.23	39682.990	13.42	40737.054	10.60
38555.461	12.15	38942.399	11.25	39683.999	13.68	40746.057	10.57
38556.463	12.08	38943.379	11.27	39684.958	13.69	40747.023	10.80
38557.463	11.82	38965.338	11.33	39702.938	12.94	40748.063	10.53
38560.419	11.87	38966.309	11.39	39708.896	12.35	40762.999	10.68
38562.423	12.10	38971.316	11.49	39709.886	12.35	40764.039	10.81
38578.377	12.02	38972.330	11.47	39710.896	12.24	40822.828	11.02
38580.383	12.10	38992.267	11.45	39972.198	11.78	41066.194	10.86
38583.381	12.06	38994.229	11.49	39976.177	11.82	41120.024	10.93
38584.381	12.10	38995.229	11.50	40000.090	11.85	41122.038	10.74
38585.381	12.06	39187.576	11.27	40010.063	11.85	41123.035	10.93
						41147.917	10.81

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ZZ Hyi IS A POORLY STUDIED GALAXY

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The variability of ZZ Hyi (S 6653) within $16^{\mathrm{m}}\!.5 - 17^{\mathrm{m}}\!.5$ pg was announced by Hoffmeister (1963) who had considered it a possible RR Lyrae star, difficult for investigation because of being faint. His published declination for the star was wrong by one degree. The star was later studied by Geßner (1981) who corrected the declination. She gives the variability range as $16^{\mathrm{m}}\!.6$ – $(17^{\mathrm{m}}$, also calls the object a possible RR Lyrae star, and presents four times of brightening.

In the course of our work on improving coordinates for all stars of the GCVS Volume II, ZZ Hyi was confidently identified with an object in the US Naval Observatory A2.0 catalog (Monet et al., 1998) at the following position: $0^{\mathrm{h}}27^{\mathrm{m}}48^{\mathrm{s}}\!.07$, $-78^\circ37'44''\!.8$ (2000.0), with the blue and red magnitudes of $13^{\mathrm{m}}\!.2$ and $12^{\mathrm{m}}\!.7$, respectively. In the Hubble Space Telescope Guide Star Catalog (Lasker et al., 1990), this is a non-stellar object GSC 9350.1587 ($14^{\mathrm{m}}\!.9$). We have inspected five images of the field from large Schmidt telescopes made available by the US Naval Observatory (USNO Pixel Server). The two images in blue light and three images in red light show that the object is definitely non-stellar; some hints to a spiral structure can be noticed, and the object is more compact in red light, suggesting that it is a spiral galaxy. The brighter magnitudes in the USNO A2.0 catalog and Guide Star Catalog compared to Sonneberg data are probably just due to the extended appearance of the object. Its variability found in Sonneberg cannot be real but rather reflecting variations of seeing.

The finding chart from Hoffmeister (1963) is reproduced in Fig. 1, and the image of the field from the Digitized Sky Survey is presented in Fig. 2.

Strangely enough, we could not find the galaxy among objects studied in the optical range and listed in the NED extragalactic data base (http://nedwww.ipac.caltech.edu/), despite its rather high brightness. The only object suggested by the data base within $3'$ from the position of the galaxy is the radio source PMN J0027–7838 in $1'\!.3$ from it, at nominal position $0^{\mathrm{h}}27^{\mathrm{m}}24^{\mathrm{s}}\!.2$, $-78^\circ38'14''$ (Wright et al., 1994). The rather poor positional accuracy of the radio source (uncertainties of $\sim 2'$ in both coordinates) does not exclude identification, though spiral galaxies are seldom associated with radio sources.

We found the star in the Lyon–Meudon (LEDA, (http://leda.univ-lyon1.fr/)) extragalactic data base as an object of the Catalogue of Principal Galaxies (PGC, Paturel et al., 1989). It is PGC 232232, a galaxy with integrated B magnitude $16^{\mathrm{m}}\!.78$. The LEDA data base also gives no information on the galaxy's radial velocity.

We would like to encourage astronomers with access to southern telescopes to verify the spiral nature of the object and to measure the galaxy's redshift.

Thanks are due to Drs. N. Samus and O. Silchenko for helpful discussion, to A. Holl for turning my attention to the LEDA data base. Our work on variable star catalogs is supported, in part, by grants from the Russian Foundation for Basic Research, Russian Program of Support for Leading Scientific Schools, anf Federal Program "Astronomy". I gratefully acknowledge the use of the LEDA and NED data bases and of the US Naval Observatory Pixel Server.

Figure 1. A reproduction of the finding chart from Hoffmeister (1963). South is at the top.

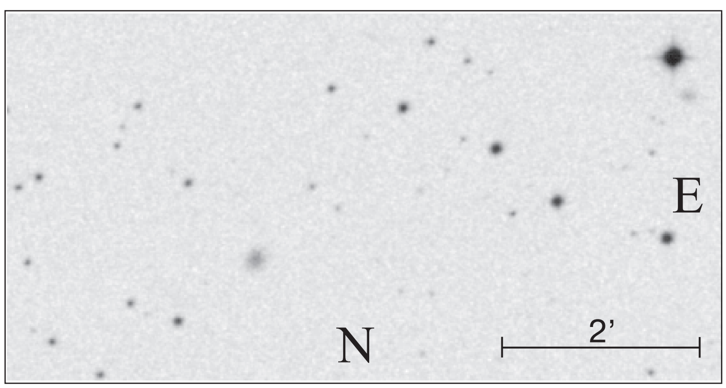

Figure 2. A DSS-II red image of the field of ZZ Hyi. South is at the top.

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USNO A 1125.14834179 IS A MIRA VARIABLE

MASI, GIANLUCA

Via Madonna de Loco, 47 03023 Ceccano (FR) Italy; e-mail: gianmasi@fr.flashnet.it

Name of the object:
A1125.14834179 in USNO A2.0

Equatorial coordinates:	**Equinox:**
R.A.= $19^h59^m41\overset{s}{.}90$ **DEC.=** $+22°33'50\overset{''}{.}0$	2000.0

Observatory and telescope:
“Bellatrix” Astronomical Observatory; 15cm, f/5 reflector

Detector:	CCD SBIG ST-7 (based on the Kodak KAF0400 chip: 765*510 pixels)
Filter(s):	None
Comparison star(s):	A1125.14828225 in USNO A2.0, $R = 14\overset{m}{.}5$
Check star(s):	A star in the field (no ID available)

Availability of the data:
Available through the IBVS web-site. (5197-t1.txt)

Type of variability:	M

Remarks:
The V−C1 light curve shows a total magnitude range of about 2.7 mag., with a cycle-length of about 270 days (Figure 2), which is typical of Mira-type variables. The red colour of the star in the USNO-A1.0 catalogue indicated that it was a Mira or a semiregular variable (Skiff 1977), but it didn't appear in the IRAS point-source, the MSX and the 2MASS catalogues. If we assume that the zero-point is close to the standard Cousins R system, then the variable has a range of $13\overset{m}{.}9 < R < 16\overset{m}{.}5$. Since the variable is somewhat redder than the comparison stars, and given the extended red sensitivity of the unfiltered CCD, the true R magnitudes are likely somewhat fainter. The *rms* scatter of the differential magnitude of C1−C2 is $0\overset{m}{.}02$.

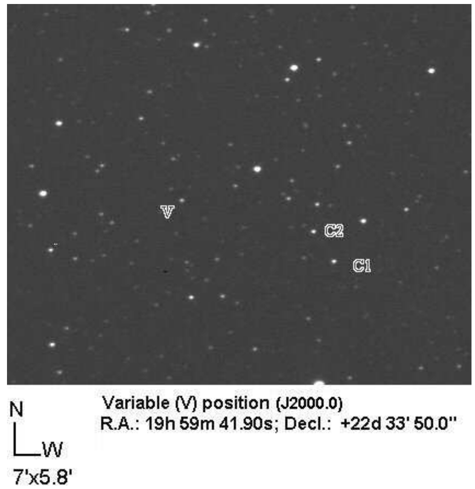

Figure 1. Identification chart for USNO A 1125.14834179.

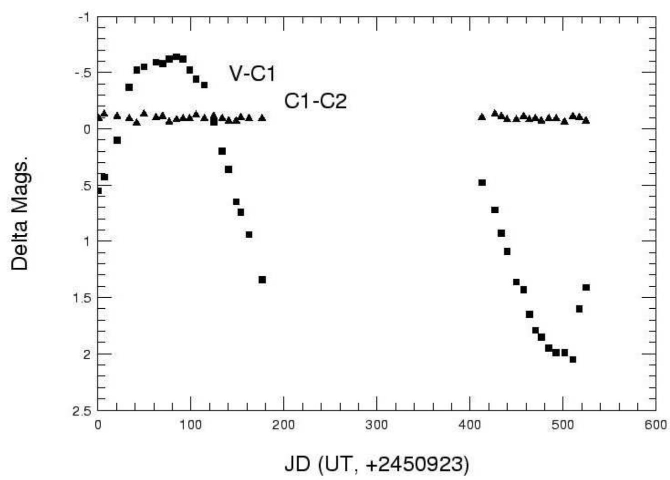

Figure 2. Differential light curves of USNO A 1125.14834179−C1 and C1−C2.

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PHOTOMETRY AND SPECTROPHOTOMETRY OF THE NEW VARIABLE STAR IRAS 20192+3025

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IRAS 20192+3025 is a red giant star located at R.A. $= 20^h21^m17\overset{s}{.}48$ DEC. $=+30°34'41\overset{''}{.}6$ (Equinox J2000, Epoch 2001.644). Photometric and spectrophotometric observations were taken at West Skies Observatory (MPC code 451) in Mulvane, KS, USA. The telescopes used were 0.2m and 0.25m Schmidt-Cassegrains. V and I_{kc} filters were used in conjunction with an SBIG ST-8 CCD camera. The observations were reduced to the Johnson V and Cousins I band photometric systems. The comparison star was HIP 100384 (V=6.77, B−V = 0.261 ± 0.011, V−I_c = 0.22 ± 0.03) and the check star was HIP 100369. The individual observations are available from the IBVS website as 5198-t1.txt .

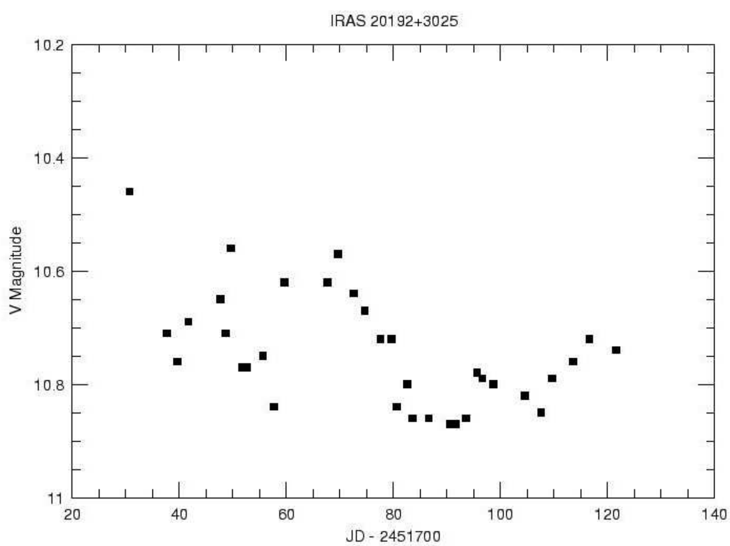

Figure 1. V band photometry of IRAS 20192+3025. The V band photometry demonstrates multi-periodic behavior.

A spectrum was taken using a non-objective slitless spectrometer (West et al. 2000). The spectrometer consists of a Rainbow Optics grating mounted to the CCD camera.

Wavelength calibration was accomplished using the hydrogen lines from A type stars and a laboratory mercury emission lamp. The wavelength accuracy is ± 20 Ångström. The spectrum is flux calibrated relative to Vega. The "+ Cont." term in the flux represents the difference in air mass between the target star and the Vega calibration spectrum. The signal-to-noise for the spectrum is greater than 10. The slope of the spectrum and the TiO band heads at 5167, 5847, 6536, 7054, 7594 Ångström are consistent with a M4III star (Celis 1984, and Serote Roos et al. 1996).

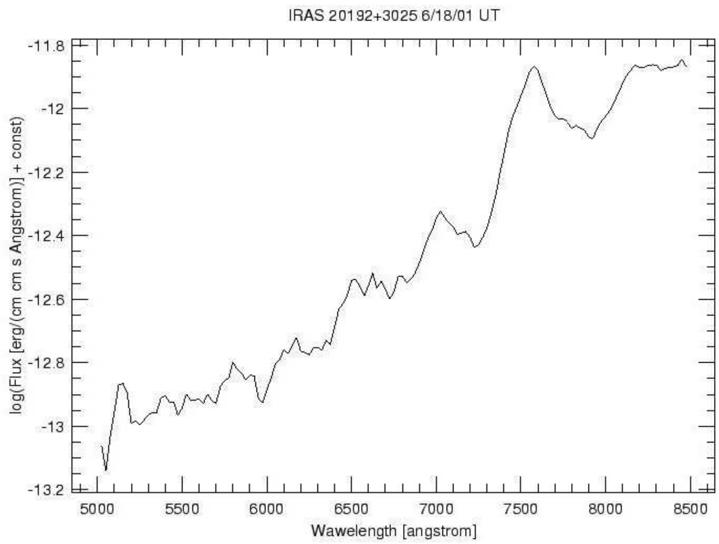

Figure 2. A low-dispersion spectrum of IRAS 20192+3025 taken on 6/18/01 with a non-objective slitless spectrometer. The TiO bands are evident.

This variable star is not listed in the GCVS. Based on the photometry and spectrophotometry reported in this paper, the type of variability is consistent with the SRB designation. Averages for the photometry are: V = 10.74, I_c = 7.02, and $V-I_c$ = 3.72. Stars with this large a $V-I_c$ fall into the M6 spectral class (Bessell). Analysis of the V and I_c band photometry with the computer program AVE shows a multi-periodic waveform. The two dominant periods from the 94 days of observation are 20.9 ± 2.4 and 40.6 ± 1.3 days. It is not yet clear if these periods are significant, or if they represent independent variations in the brightness of the star. Observations over a longer baseline will be required to resolve all of these issues. Based on the photometry and spectrophotometry one concludes that IRAS 20192+3025 is a M4III to M6III variable star of type SRB.

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DETECTION OF A TERNARY SPECTRUM IN HD 216608

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This star (HD 216608, HR 8708, SAO 52465, HIP 113048, BD +43 4331) is a visual binary system ADS 16345 AB. The B companion (F6V star) revolves about the primary with a period of 105 yr, major semi-axis of 0.”60 and $M_\mathrm{A} + M_\mathrm{B} = 2.62 M_\odot$ (Finsen & Worley 1970, Söderhjelm 1999). HIPPARCOS lists the visual B companion separated by $0\farcs95$ (ESA 1997). Fabricius & Makarov (2000) obtained the following magnitudes in the Tycho passbands: $B_T = 6\overset{\mathrm{m}}{.}29, V_T = 6\overset{\mathrm{m}}{.}01$ for the A companion and $B_T = 8\overset{\mathrm{m}}{.}43, V_T = 7\overset{\mathrm{m}}{.}81$ for the B companion. There is also an optical C companion, $10\overset{\mathrm{m}}{.}7$, at $28\farcs0$ (Abt & Levy 1985). The brightest member (HD 216608A) is an SB1 binary. It was first reported as variable in radial velocity by Young (1939). Later on this was confirmed by Abt et al. (1980). Its Am characteristics were discovered by Walker (1966) who also are A2V spectral type and $v \sin i = 50$ km s^{-1}. Cowley et al. (1969) classified the star as A3m, Abt (1981) as Am and A3/F0V/F4 from the CaII K/Hydrogen/Metallic lines (abbreviated usually as K/H/M). Another classification is proposed by Sreedhar Rao & Abhyankar (1991) according to the K, m39, m43 and SrII 4077 lines: A3V, F2III/IV, F2III/IV and Ap, respectively. Orbital elements ($P_\mathrm{orb} = 24\overset{\mathrm{d}}{.}1635$, $e = 0.2$, $K = 10.1$ km s^{-1}) were derived by Abt & Levy (1985) from the photographic plates with a resolution of 0.4 Å and a dispersion of 16.9 Å mm^{-1}. They also give spectral types A2/A8/F2 from the K/H/M lines, respectively. Abt & Moyd (1973) measured $v \sin i = 35$ km s^{-1} while Abt & Morrell (1995) obtained $v \sin i = 46$ km s^{-1} from CCD spectra with a resolution of 0.33 Å. They also reclassified the star as Am (A2/F1/F2). Tokovinin (1997) estimated the following masses for the companions: $M_\mathrm{Aa} = 2.54 M_\odot$, $M_\mathrm{Ab} \geq 0.27 M_\odot$, $M_\mathrm{B} = 1.25 M_\odot$.

Our spectroscopic observations were carried out with the 2m RCC telescope of the Bulgarian National Astronomical Observatory in the frame of our observational program on Am stars in binary systems. The Photometrics AT200 camera with a SITe SI003AB 1024×1024 CCD chip, (24 μm pixels) was used in the Third camera of the coudé spectrograph to provide spectra in the 6400–6500 Å region with R = 32000. The typical S/N ratio is about 300. IRAF standard procedures have been used for bias subtracting, flat-fielding and wavelength calibration. Telluric lines have been removed using spectra of hot, fast rotating stars. Wavelength calibration has the r.m.s. error of 0.005 Å. The log of observations is listed in Table 1.

Table 1: List of observations: Date, HJD of the beginning of the exposure and effective exposure time.

Sp.No.	Date	HJD (2450000+)	Eff. exp. (in seconds)
1	10.6.2001	2071.496	3000
2	30.8.2001	2152.408	7210
3	2.9.2001	2155.364	4280

A small portion of all the three spectra in the vicinity of CaI 6439 which is most illustrative is depicted in Fig. 1. We have chosen this line as it is free of blends. It is apparent that there are two systems of sharp lines travelling and crossing in the spectra. Nevertheless, all the lines in the spectra are broader and stronger than what could be expected from a simple sum of both sets of sharp lines (note e.g. the Fe lines). This fact seems to be caused by a third faster rotating star which does not seem to have moved in our 3 spectra within the precision of measurements.

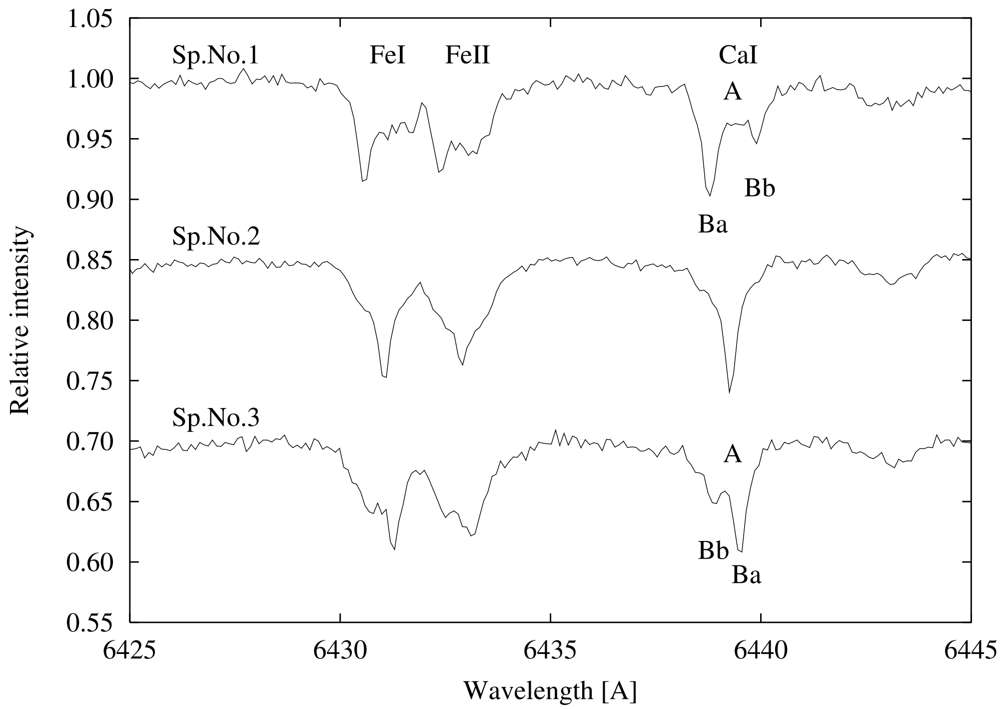

Figure 1. Three successive spectra of HD 216608. While Ba and Bb lines are clearly separated on the first spectrum, they shade in the next spectrum to become separated again in the third spectrum. Lines of the A component are much wider and do not seem to have moved.

Based on what is known about the system, one could conclude that the apparently moving sharp line components are formed in the above mentioned SB1 system HD 216608A while the broad line component belongs probably to the visual B companion. However, this interpretation has serious gaps. The visual A companion is hotter and brighter than the B companion and it is hardly probable that it has much sharper lines than the B one. Considering the synchronization mechanism of Tassoul & Tassoul (1992) stretching to relatively long orbital periods could partly avoid the problem. However, these sharp lines, although very pronounced, carry only a very small amount of the total equivalent width of the ternary blend especially in iron lines. This guides us to suggest that the sharp lines belong rather to the visual B companion which thus seems to be a new SB2 binary. We will denote the deeper lines as the primary (Ba) and the less pronounced sharp lines as the secondary (Bb). The broad lines would then originate from the A companion. The broad components of the Ca lines are relatively much weaker than those of Fe lines what confirms the Am characteristics of HD 216608A making both sharp line components more outstanding in Ca than in Fe.

The above accounts were confirmed by fitting the CaI line with three gaussians (Kratka 1988; Sp. No. 2 only with two gaussians as Ba and Bb overlap). All three spectra give a consistent output as far as the depth and half-widths of all 3 components is concerned what gives firmer footing to the result presented above (see Table 2). This also explains the inconsistent rotational velocities of different authors ranging from 35 to 50 $\mathrm{km\,s^{-1}}$. Under the assumption that the velocity of the mass centre of Ba+Bb did not change during the summer, we get from the Sp. No. 1 and 3 for the mass ratio: $M_{\mathrm{Ba}}/M_{\mathrm{Bb}} = \Delta v_{\mathrm{Ba}}/\Delta v_{\mathrm{Bb}} = 47.9/34.4 = 1.39$. This mass ratio then yields radial velocity of the mass center Ba+Bb: $v_{\mathrm{B}} = 8.0\ \mathrm{km\,s^{-1}}$. This value is consistent with the radial velocity of the Ba+Bb blend from Sp. No. 2 where Ba and Bb lines roughly overlap. The estimated 1σ precision of our radial velocity measurements is about 1 $\mathrm{km\,s^{-1}}$ for the sharp Ba and Bb lines and about 4 $\mathrm{km\,s^{-1}}$ for the broad A companion lines.

Finally, we have used the spectrum synthesis code SYNSPEC (Hubeny et al. 1995, Krtička 1998) to fit the spectra and estimated the following values of $v \sin i$: 9, 5, 43 $\mathrm{km\,s^{-1}}$ for Ba, Bb and A component, respectively. An allowance for the instrumental profile was included in the above procedure. In the case of both sets of sharp lines it makes no sense to correct for another free parameter, thus microturbulence was set to zero. Consequently, their rotational velocities are rather upper limits. In the case of broad lines microturbulence of about 2 $\mathrm{km\,s^{-1}}$ was considered which made a better fit of the iron lines. In our opinion sharp Ba and Bb lines cause heavy blends of broad A lines and could have affected previous radial velocity measurements in lower resolution leading to a spurious orbit. The previous mass estimates of all the components and the very SB1 nature of the HD 216608A must certainly be revisited in the future. It is HD 216608B which seems to be a newly discovered SB2 binary.

Table 2: Results of the CaI 6439 line fitting.

Sp.	central depth			gaussian half width Å			rad. velocities [$\mathrm{km\,s^{-1}}$]		
No.	Ba	Bb	A	Ba	Bb	A	Ba	Bb	A
1	0.069	0.026	0.035	0.16	0.11	0.70	-14.2	38.9	12.1
2	0.068		0.041	0.12		0.52	9.6		4.0
3	0.064	0.018	0.035	0.14	0.12	0.60	20.2	-9.0	0.5

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FIRST GROUND-BASED PHOTOMETRY AND PRELIMINARY PHOTOMETRIC ELEMENTS OF CONTACT BINARY DN Cam

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The variability of DN Cam (NSV 1685, HD 29213, HIP 21913, $4^{\mathrm{h}}42^{\mathrm{m}}46\overset{\mathrm{s}}{.}2$, $+72°58'41\overset{''}{.}9$, 2000.0) was first suspected by Strohmeier (1959). Since the object is quite bright (V_{max} = 8.23, V_{min} = 8.73) it was included into the Hipparcos mission. According to the Hipparcos photometry the system was classified as an EB type variable with the following ephemeris for the primary minimum (ESA, 1997):

$$\text{Min I} = 2\,448\,500.488 + 0.498312 \times E \tag{1}$$

The system was observed spectroscopically by Rucinski et al. (2001). Careful analysis of the broadening functions lead to the following spectroscopic elements $V_0 = 6.04\pm0.98$ km.s^{-1}, $K_1 = 105.45\pm0.65$ km.s^{-1}, $K_2 = 250.62\pm1.91$ km.s^{-1}, $q = K_1/K_2 = 0.421\pm0.006$ resulting in $(m_1+m_2)\sin^3 i = 2.336\pm0.05$ $M_\odot$ and spectral type F2V. The authors noted discrepancy between the absolute magnitude determined from the Hipparcos parallax $\pi = 4.49\pm0.89$ mas and that determined from the period-colour-luminosity relation of Rucinski & Duerbeck (1997). Apart from the Hipparcos photometry no photoelectric or CCD light curve of the system has been published. Therefore we included the system into the photoelectric monitoring of contact binaries.

New UBV light curves of DN Cam were obtained at the Stará Lesná observatory of the Astronomical Institute of the Slovak Academy of Sciences. The observations were taken on three nights September 3, October 4 and November 2, 2001. The 0.6-m Cassegrain telescope equipped with a single-channel photoelectric photometer was used. Data reduction, the atmospheric extinction correction and transformation to the standard international UBV system were carried out in the usual way (see Pribulla et al., 2001). SAO 5285 was used as the comparison star for all observations. All individual observations are available in file 5200-t1.txt.

Our observations were used to determine 4 new minima times (Table 1) using Kwee & van Woerden method. UBV observations, shown in Fig. 1, were phased using the linear ephemeris:

$$\text{Min I} = \text{HJD } \underset{\pm 7}{2\,452\,156.5817} + \underset{\pm 2}{0.4983091} \times E, \tag{2}$$

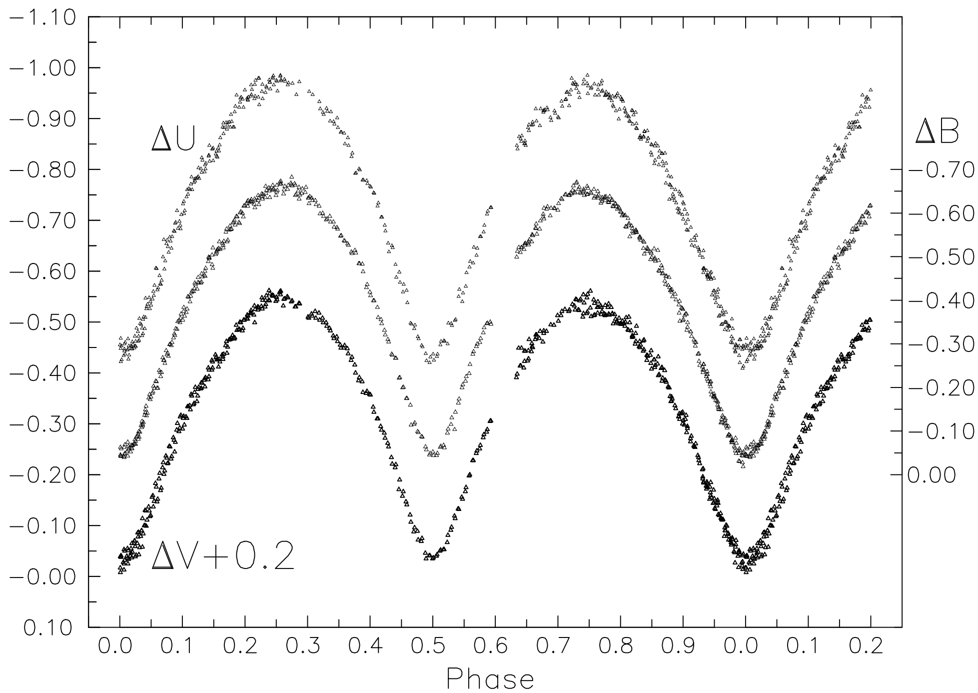

Figure 1. *UBV* light curves of DN Cam with respect to SAO 5285 according to ephemeris (2)

determined from our 4 photoelectric minima (w = 2), Hipparcos $JD_0 = 2\,448\,500.4880$ (w = 2) and time of the conjunction determined from the spectroscopy $T_0 = 2\,451\,679.6954$ ($w = 1$).

The shape of the minima (Fig. 1) indicates that the system is very probably partially eclipsing. It is interesting to note that the minima are nearly of the same depth. Since the mass ratio was reliably determined, we tried to found preliminary photometric elements.

The photometric elements were determined using the 1992 version of the Wilson & Devinney (1971) code. Mean temperature of the primary $T_1 = 6700$ K was fixed according to F2V spectral type using the calibration of Popper (1980). The limb and gravity darkening coefficients as well as bolometric albedos were fixed appropriate to the convective envelope and a mean effective temperature. The third light was set to zero because there is no indication of the third component in spectroscopy. The resulting photometric elements are: $q = 0.421$ (adopted from spectroscopy), $i = 71.9\pm0.1°$, fill-out $= 0.50\pm0.02$, $T_2 = 6911\pm11$ K. The corresponding fits are depicted in Fig. 2. Although the V passband

Table 1: New times of the primary (I) and secondary (II) minima obtained at the Stará Lesná observatory. The standard errors of the minima are given in parentheses. The (O-C) residuals are given with respect to ephemeris (1)

JD_{hel} 2 400 000+	type	(O-C)
52156.5825(2)	I	-0.0206
52186.4815(1)	I	-0.0204
52216.3785(1)	I	-0.0221
52216.6283(2)	II	-0.0214

fit is quite good, there are discrepancies in the maxima heights in the U and B passbands. The secondary minimum in U is much deeper than predicted.

The secondary component is hotter so the system is of a W subtype. Its characteristics (relatively long orbital period, early spectral type and high fill-out) are, however, in disagreement odds with those of most W-subtype contact binaries. The inclination angle combined with spectroscopic elements leads to the following masses of the components: $m_1 = 1.915 \pm 0.036$ $M_\odot$ and $m_2 = 0.805 \pm 0.012$ $M_\odot$.

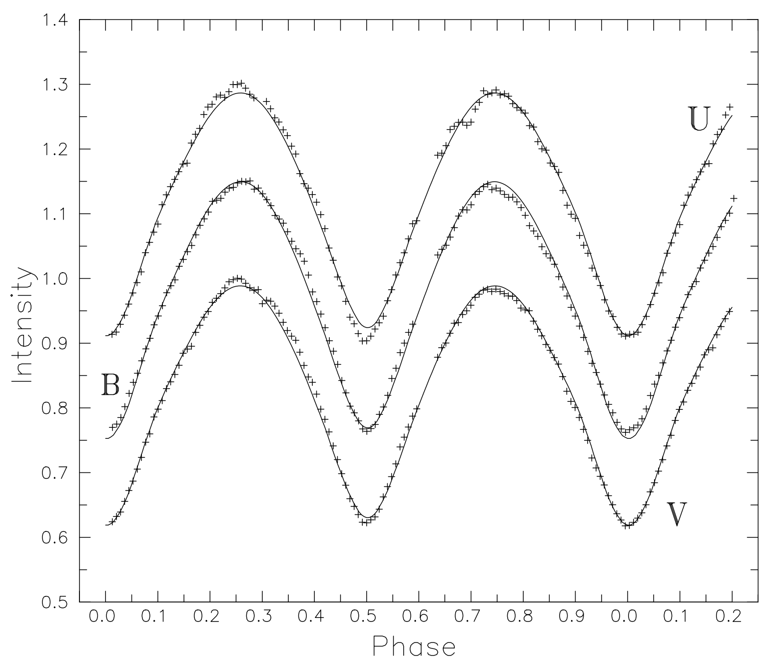

Figure 2. The best fits to the UBV observations. The U and B passband observations are shifted in intensities by 0.15 and 0.30, respectively

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